New psychoactive substances: The current EU landscape

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https://doi.org/10.3013/5mqec306

Abstract

New psychoactive substances (NPS) pose a growing global public health threat and an ever-changing and complex challenge for law enforcement efforts. Due to their ambiguous legal status across Europe and beyond, they are designed to replace traditional controlled drugs while evading detection measures. Each year, hundreds of new substances are detected and monitored by the EU Early Warning System. Nevertheless, there remains a limited knowledge base available for NPS. The current understanding of the public health threats posed by NPS is limited, predominantly due to their continually changing chemical composition. Due to these chemical modifications, traditional detection methods are unlikely to detect NPS, further challenging their tracking and control by law enforcement agencies. In this paper, we review the available literature on the current criminological landscape for NPS, including their prevalence, detection-resistance concealment methods, criminal modus operandi, presence online and potential health impacts on society. This work is supplemented by data collected through consultations with subject-matter experts as part of a European project that attempts to combat the illicit drug trafficking chain. On this basis, we identify gaps related to the knowledge and capability needs of law enforcement agencies in relation to NPS and formulate recommendations for future work.

Keywords: new psychoactive substances (NPS), drugs, EU landscape, NPS prevalence, organised crime.

Introduction

New psychoactive substances (NPS) reported on global markets are on the rise. According to the United Nations Office on Drugs and Crime (UNODC) definition, NPS are 'substances of abuse, either in pure form or a preparation, that are not controlled by the 1961 Single Convention on Narcotic Drugs or the 1971 Convention on Psychotropic Substances, but which may pose a public health threat'. The market for NPS began to rapidly expand in 2008 (EMCDDA, 2022), and since then around 1 200 NPS have been identified on the global drug market by the end of

2023 (EMCDDA and Europol, 2024a). However, due to control disparities, the estimation of the NPS market volume and the efforts to tackle it are greatly challenged, posing a significant risk to public health and obstructing drug policy (UNODC, 2020; UNODC, n.d.).

The adaptable nature of NPS enables the individuals producing, trafficking, dealing and using them to avoid controls and evade legal restrictions. NPS producers exploit the adaptability of the substances, leading to the continuous emergence of NPS achieved through minor chemical structural modifications. This facilitates the evasion of regulatory controls and places NPS in a legal grey area, enabling their production and relatively risk-free transportation and dealing (Lin et al. 2023). Although the overall number of NPS appearing for the first time in Europe has decreased in recent years, a record of over 30 tonnes of NPS was seized in 2022, consisting of a relatively small number of large-quantity seizures. However, detection capabilities are not consistent across the continent, which leads to under-reporting. The NPS market in Europe is dynamic, with hundreds of substances being added and monitored annually by the EU Early Warning System (EWS). The variations in national drug controls allow criminals to exploit this caveat, leading to the re-emergence of certain NPS after extended periods of absence (EMCDDA and Europol, 2024b). The majority of NPS are sold online and are reportedly often distributed to end users via postal or courier services, making digitalisation a strong NPS facilitator and stressing the need for effective and efficient measures to monitor and control online sales. Although most of the NPS on the European market are shipped from China and India, there is also some synthetic cathinone production observed domestically, and recent reports suggest that synthetic cannabinoids could also be actively produced in Europe (EMCDDA and Europol, 2024a). Threats of increased European production of NPS arise due to the limited control over the majority of NPS precursors, escalating the public health threats (EMCDDA and Europol, 2024b). Criminals use legal loopholes to obtain the chemicals needed to produce NPS, as these chemicals often have legitimate uses, such as pharmaceutical or industrial applications, but are usually scheduled and subject to national or international controls. For example, Regulation (EC) No 273/2004 (European Parliament and Council of the European Union, 2004) sets out provisions on the licences, labels and customer declarations needed for the control and monitoring of scheduled substances, enabling the control of precursors' presence on the market for legitimate uses and the limitation of their illicit diversion. Alternatively, to avoid the use of scheduled chemicals, criminals may attempt to use non-scheduled chemicals to produce NPS and controlled drugs; however, this may also increase their risks of detection due to the greater amounts of waste generated (EMCDDA and Europol, 2024b).

There is generally a limited intelligence picture of NPS due to the lack of systematic global control. Nevertheless, this paper indicates the role of NPS in the wider drug trafficking chain using the latest available data, along with the challenges this poses for law enforcement. These findings are further supported by primary data from consultations with subject-matter experts.

Research methodology

In order to promote a more extensive understanding of the complex EU NPS landscape, this research embraces a twofold approach, consisting of an expansive desk-based literature review and detailed written expert consultations.

Stage 1: Literature review

The extensive desk-based research provides a comprehensive overview of the types of NPS observed on the European market, along with the current criminological landscape for NPS, including their prevalence, detection-

resistance concealment methods, presence online, risks and potential health impacts. A variety of sources were reviewed, including academic articles, reports and official web sources, as the literature review also informed the development of the data collection instrument used for the written expert consultations.

Stage 2: Expert consultations

Supplementary to the literature review, written consultations were conducted with subject-matter experts. The selected occupational groups of experts were European law enforcement agencies (LEAs) and postal services. Both groups are essential for the tackling of NPS trafficking, with postal services being central to the efficient monitoring and interception of NPS trafficked via mail – a modus operandi frequently reported in the literature relating to NPS.

First-hand data from LEAs and postal services was collected through a structured set of questions, aiming to enhance the understanding of European LEA practices, NPS prevalence, technological capabilities and overall challenges. The consultation questions, information sheets and consent forms were approved by Sheffield Hallam University's ethics committee (ER62292219) and disseminated to the LEAs and postal services partnering in the Horizon Europe project ARIEN, which aims to combat the illicit drug trafficking chain. The documentation was sent by email, and the respondents were asked to return the completed documents to the researchers in a similar manner. The completed consultations were pseudonymised upon collection and kept separately from participants' consent forms. A total of 11 participants from five countries – Albania, Kosovo, the Republic of Moldova, Slovenia and the United Kingdom – took part in the written expert consultations, with LEA representatives from all five countries and postal service representatives only from Slovenia. The data was analysed in NVivo.

Literature review

NPS groups and prevalence

The literature consistently showed that the global NPS landscape is diverse and dynamic, with around 1 200 unique NPS identified by 139 countries globally between 2008 and 2023, and the emergence of over 960 of them reported in Europe between 1997 and 2023 (EMCDDA and Europol, 2024a). NPS affect countries and regions in different ways, leading to countries facing differing challenges when addressing an NPS issue and increasing the complexity of tackling NPS at the global and regional levels. The vastly unknown health impacts of NPS further increase the public threats they pose. Generally, the psychological and physiological effects of NPS can be sorted into stimulant-type (e.g. traditional cocaine, amphetamine and ecstasy), sedative-hypnotic-type (e.g. benzodiazepines), dissociative-type (e.g. ketamine) and hallucinogenic-type (e.g. LSD (lysergic acid diethylamide)) (EMCDDA, 2022). The biggest group of NPS reported for the first time on the global UNODC Early Warning Advisory (EWA) in 2023 were synthetic opioids (36 %), followed by stimulants (24 %) and synthetic cannabinoids (24 %), hallucinogens (12 %), and new benzodiazepines (4 %) (UNODC, 2024). Over 26 000 seizures of NPS were reported in 2022 in the EU, which amounted to more than 30 tonnes. Cathinones accounted for the greatest number of seizures (36.6 %), followed by cannabinoids (17.7 %), miscellaneous NPS (16.8 %), arylcyclohecylamines (14.9 %), phenethylamines (5 %), benzodiazepines (2.8 %), opioids (2.8 %), arylalkylamines (1.6 %), and tryptamines, piperidines and pyrrolidines, piperazine derivatives, and aminoindanes (each reported in less than 1 % of the seizures) (EMCDDA and Europol, 2024a). Below, some of these NPS groups are described in detail, based on the available data and on the potential level of risk they pose to the public.

Benzodiazepines are an important group of medicines first introduced in the 1950s that produce sedation and promote sleep, and are the most widely prescribed medicine group globally. However, they can cause rapid tolerance and dependence, potentially resulting in life-threatening withdrawal symptoms; thus, their prescription is subject to very strict restrictions. The combination of benzodiazepines with alcohol, opioids or other psychoactive substances increases the risks of fatal and non-fatal poisonings. The demand for benzodiazepines is strong and motivates criminals to divert legitimate medicines from the pharmaceutical market to the illicit one, sell unlicensed products or produce falsified benzodiazepines. The illicit pharmaceutical market has been found to contain both legitimate benzodiazepines and new benzodiazepines. The most frequently observed new benzodiazepines on the drug market are diazepam ('street Valium') and alprazolam ('fake Xanax'). New benzodiazepines are also sold as separate substances promoted to enhance the effects of other drugs, and for self-medication. Most of the new benzodiazepines are imported from China as powders, which are then made into tablets in Europe, allowing them to mimic the legitimate medicines; however, new benzodiazepines are reportedly also concealed and smuggled into prisons by infusing them into paper and clothing (EMCDDA and Europol, 2024a). Reports to the EU EWS for 2022 show that over 750 seizures of new benzodiazepines were conducted in the EU, accounting for around 3 % of all NPS seizures for that year. In terms of benzodiazepines, the European market in 2022 was dominated by etizolam (42.5 % of the total quantity seized) and flualprazolam (8.9 % of the total quantity seized), which were seized in powder, liquid and tablet forms, predominantly in northern Europe (EMCDDA and Europol, 2024a). Although the quantity of seized etizolam in 2022 was consistent with that seized in 2020, the quantity of seized flualprazolam decreased by more than half in the same period (21 % for 2020 (EMCDDA, 2022)), indicating that distributors and producers are shifting towards other new benzodiazepines (e.g. flubromazolam, clonazolam and bromazolam) to avoid the international controls on etizolam and flualprazolam implemented in late 2020 (EMCDDA and Europol, 2024a). New benzodiazepines can often be more potent than legitimate benzodiazepines, posing threats to public health (EMCDDA, 2022).

New opioids account for only a fraction of all NPS reported and seized in Europe, but are the most prominent NPS group (36 %) in terms of new substances that emerged and were reported to UNODC's EWA in 2023 (UNODC, 2024). Furthermore, they are of particular concern to public health due to their lethally high potency, leading to a high risk of life-threatening overdose due to respiratory depression (EMCDDA and Europol, 2024a). The majority of reported NPS opioids are fentanyl derivatives – specifically carfentanil (EMCDDA, 2020; EMCDDA and Europol, 2024a). Fentanyl and fentanyl analogues are highly potent substances, as the 'parent' substance – fentanyl – is between 50 and 100 times stronger than morphine. For instance, acetylfentanyl is approximately 15 times stronger than morphine, and carfentanil is approximately 10 000 times stronger than morphine. There is no known dose of carfentanil and other fentanyl analogues that is not lethal to humans. Criminals exploit the potency of fentanyl and fentanyl analogues by replacing a significant portion of their heroin with smaller amounts of the potent fentanyl analogues mixed with bulking agents, leading to uneven blends with high fentanyl concentrations and increasing the risks of fatal overdoses (National Crime Agency, 2019). New opioids are mostly sold as powders, but can also be found as tablets, capsules and liquids. The majority of the new opioids available in Europe originate from China, predominantly nitazene opioids, with Russia being the main source for carfentanil and India for tramadol. European sites linked to new opioids are rarely reported, and are mainly concerned with the mixing and packaging of the imported material. The first discovery of a potential European site where the production of new opioids – more specifically, fentanyl – took place was made in 2023 in Latvia, where 2 kg of fentanyl and various precursors and chemicals for its production were seized (EMCDDA and Europol, 2024a). New opioids are the fourth-largest NPS group monitored by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA), now the European Union Drugs Agency (EUDA). Almost 750 seizures of new opioids were reported to the EU EWS in 2022, accounting for 3 % of the total

number of NPS seizures that year. Meanwhile, carfentanil has remained active, accounting for 40 % of the total new opioid seizures for 2022 and 49 % of the seized new opioids, with the majority of seizures reported in the Baltic region. The lethally high potency of new opioids and their exploitation by criminals pose a particular public health threat (EMCDDA and Europol, 2024a).

Synthetic cathinones are closely related to the phenethylamine family, which includes amphetamine and methamphetamine. Cathinone, the principal active ingredient found in the leaves of khat plants, is considered to be the prototype from which a range of synthetic cathinones have been developed. They act as central nervous system stimulants that mediate the activity of dopamine, norepinephrine and serotonin, mimicking the effects of cocaine, ecstasy, amphetamine and methamphetamine (UNODC, n.d.). By 2019, the majority of the synthetic cathinones seized at the EU's external borders originated in China; however, reports evidence that there has been a sharp rise in synthetic cathinones originating in India and targeted at European markets in recent years. Almost 70 illicit laboratories producing synthetic cathinones have been dismantled in Europe since 2013, with most of the sites being in Poland (77 %), the Netherlands (17 %), Spain, France and Slovakia (2 % each), with most of them producing 4-MMC and 4-CMC (EMCDDA and Europol, 2024a). Cathinone is structurally related to amphetamine, ephedrone to methamphetamine, and methylone to MDMA (3,4-methylenedioxymethamphetamine). The only cathinone derivatives under international drug control are amfepramone and pyrovalerone (UN 1971 Schedule IV), and methcathinone (UN 1971 Schedule I). Synthetic cathinones are often found in products sold as 'research chemicals', 'plant food', 'bath salts' or 'glass cleaner', usually in powder or tablet form. Mephedrone and methylone are typically sold as white or brown powders or as pills, often marketed as 'ecstasy'. Mephedrone is classified as Class B in the United Kingdom, is controlled at the national level in 12 EU Member States and is subject to control measures in Member States under a Council Decision adopted in 2010 (EUDA, n.d.a). Sometimes, the derivatives can be injected, although they are most often ingested or snorted. Almost 10 000 seizures of synthetic cathinones were reported for 2022, with only 78 seizures of three cathinones (3-CMC, 3-MMC and alpha-PHiP) accounting for 84 % of the total quantity of synthetic cathinones seized, which accounted for 73 % of the total quantity of NPS seized for that year (EMCDDA and Europol, 2024a). Currently, the short- and long-term effects and health risks of synthetic cathinones are largely unknown, with only a few reports on their toxicity to date and the majority of current knowledge derived from consumer reports and clinical observations. The most common observed symptoms include mild agitation and psychosis, as some of the adverse effects occur at the cardiac, psychiatric and neurological levels (EMCDDA and Europol, 2024a).

Since the introduction of national controls on mephedrone, **synthetic aminoindanes** have increased in popularity (Pinterova et al., 2017). Back in the 1970s, aminoindanes were reported to have bronchodilating and analgesic properties. Recent research evidences their potent effects on serotonin uptake and release, leading to effects similar to those of MDMA, and their trading as NPS. No aminoindanes are currently under international control. The 2-aminoindane is an amphetamine analogue, and its chemical structure can be modified to produce other substances, such as 5-IAI (5-Iodo-2-aminoindane) and MDAI (5,6-methylenedioxy-2-aminoindane). These three analogues are reported to be the most common NPS in the aminoindanes group. Aminoindanes are commonly found in powder and crystal form and are mainly ingested, but can sometimes be snorted (UNODC, 2013).

'Herbal highs' are not a recent market phenomenon and refer to the use of plant mixtures with minimal psychoactive effects. However, the composition of these herbal mixtures has changed substantially since the mid 2000s with the

introduction of **synthetic cannabinoids**. Since then, the number of new synthetic cannabinoids has greatly expanded, especially in recent years, although this expansion somewhat halted in 2023 for reasons that are still not entirely clear (EMCDDA and Europol, 2024a). The synthetic analogue of the principal psychoactive substance found in the cannabis plant – THC (tetrahydrocannabinol) – was first synthesised in 1988 under the name HU-210 and reportedly has at least 100 times more strength than THC. Due to the great similarities between the chemical structures of HU-210 and THC, the synthetic cannabinoid is categorised as a 'classical cannabinoid' and is accessible in the US market, while 'non-classical' synthetic cannabinoids have been reported by multiple countries globally. A variety of other synthetic cannabinoids that are structurally dissimilar to THC have emerged on global markets – JWH-018 consistently being the best-known, with potencies at least three times stronger than THC. THC and cannabis are controlled under several international drug control treaties; however, none of the synthetic cannabinoids are under international control, with only some countries controlling some of them at the national level. Synthetic cannabinoids usually act similar to THC and are available mostly in powder or tablet form, which is usually smoked, but can sometimes be ingested. Another consumption method is spraying liquid synthetic cannabinoids onto herbal materials or tobacco and smoking them (EMCDDA and Europol, 2024a). Most of the synthetic cannabinoids are imported as bulk powders from China, as their processing takes place in Europe. Up until 2023, reports of synthetic cannabinoid facilities in Europe were only concerned with the processing and packaging of the bulk powder; however, two sites, one in Spain and one in Greece, were identified in 2023, where evidence of synthetic cannabinoid synthesis was found, increasing the threats linked to synthetic cannabinoids for Europe even further (EMCDDA and Europol, 2024a). Synthetic cannabinoids are the largest NPS group, accounting for 25 % of all NPS in Europe, with over 4 500 seizures reported to the EU EWS in 2022 (EMCDDA and Europol, 2024a). Currently, there is limited data on the toxicity levels of synthetic cannabinoids and on their effects on the human body. Synthetic cannabinoids often contain several chemicals in different concentrations – a trait typical for NPS – thus challenging the differentiation of the effects of the various constituents. Synthetic cannabinoids have also reportedly been used to adulterate low-THC cannabis, following reports of unusual effects after consumption, which is a phenomenon observed in at least 11 Member States in 2020 and 2021. They have also been found in sweets in the EU, causing several severe poisoning cases (EMCDDA and Europol, 2024a), and in e-liquids and vaping products (EMCDDA and Europol, 2023). Due to their recent introduction to the market, some drug tests fail to detect synthetic cannabinoids, making them an attractive drug of choice for those subject to frequent testing procedures, including people in prisons and individuals undergoing drug treatments. Thus, the smuggling of synthetic cannabinoids in prisons is increasing, as the concealment methods have evolved to include paper impregnation (e.g. in letters, photographs, drawings) and vaping devices (EMCDDA, 2020).

Arylcyclohexylamines are a chemical class of drugs that were originally introduced as intravenous anaesthetics. A type of arycyclohexylamine is phencyclidine (PCP), which was first introduced in the medical industry in the 1950s, but was withdrawn due to its hallucinogenic and delirium effects and became internationally controlled. Ketamine is closely related to PCP, is a dissociative drug and is one of the oldest NPS. Ketamine abuse was first reported in the United States in the 1980s, with its emergence in Europe in the 1990s. It was originally synthesised as an anaesthetic in the 1960s and marketed as the medical alternative to phencyclidine. Ketamine underwent multiple risk assessments and was reviewed by the World Health Organization, which concluded in 2006 that the gathered information was insufficient to warrant the scheduling of ketamine (UNODC, 2013). Reports indicate that the majority of the ketamine on European markets is sourced from India, with some indications of imports from China and Pakistan. It usually reaches Europe through Belgium or the Netherlands and is often concealed using shell pharmaceutical companies, which are able to import up to 50 kg of ketamine for legitimate purposes; however,

illegitimate shipments often exceed 100 kg. Since it is rarely reported, there is limited evidence on domestic ketamine production, with a small number of seizures involving ketamine precursors and a few dismantled production sites in Belgium and the Netherlands. The dismantled sites indicated that extraction of medicinal products and ketamine crystallisation had been taking place in the facilities. Ketamine reports to the EU EWS have remained high in recent years, suggesting its established consistency on the markets. Almost 3 000 seizures of ketamine were reported in Europe in 2022, accounting for over 11 % of the total number of NPS seizures for that year, and amounting to almost 2.8 tonnes of the substance – more than double the quantity seized in 2020 (1.1 tonnes) (EMCDDA and Europol, 2024a). Ketamine is mainly snorted, but can also be injected. It has also been found in other drugs, such as MDMA and amphetamines, in combinations referred to as 'pink cocaine' or 'tucibi' (EMCDDA, 2023b).

NPS risks

The ease of purchasing NPS online increases their potential spread. The reasons why an individual might decide to use NPS vary and include self-medication, convenience, perceived safety, curiosity, self-exploration and recreation. The use of non-prescribed medication and illicit substances and the misuse of prescribed substances have shown to be more likely for individuals with unmet mental healthcare needs. A content analysis of Reddit posts investigated the occurrence and motivation of self-medication with NPS. The frequency of substances mentioned showed that etizolam and clonazolam (both benzodiazepines) were the most commonly mentioned substances between October 2022 and February 2023, followed by kratom (a plant-derived substance), 2-FMA (stimulant), ketamine (dissociative), diclazepam (benzodiazepine), 3-MeO-PCP (dissociative), flualprazolam (benzodiazepine) and 4F-MPH and 3-FPM (stimulants) (Holborn et al., 2023). Reddit users also commented that they resorted to self-medication with new benzodiazepines for the treatment of anxiety-related disorders and were drawn to using NPS after a life event, when substance substitution was needed, after being refused the prescription of higher doses of medical benzodiazepines and to manage pain and substance withdrawal. The research by Holborn et al. (2023) presents global issues with medical systems in terms of prescription of appropriate doses of medications and promoting openness, as indicated by multiple Reddit users. Stimulant-type NPS are predominantly reported for the self-medication of attention-deficit/hyperactivity disorder, as financial issues and the unlikely diagnosis of the disorder in adulthood are among the leading reasons for users to resort to NPS. Reddit users reported that their choice of utilising new stimulants is motivated by traumatic events and is a more favourable option than selective serotonin reuptake inhibitors (a group of prescription drugs mainly used to treat depression) due to the perceived reduced side effects of NPS. Overall, the motivations for NPS use for self-medication include dissatisfaction with the medical healthcare system, financial issues and the inability to receive a diagnosis.

NPS health impacts

NPS pose a growing global public health threat, designed to replace controlled and banned substances and consistently avoid controls. Their continuously changing chemical structures pose forensic, legal and law enforcement challenges, making them hard to trace and control. NPS require extensive laboratory and non-laboratory analyses and further medicolegal investigations to aid their identification, scheduling and control (Sajwani, 2023).

Illicit drugs pose a significant risk to public health, and NPS, by definition, are no exception. The use of NPS is often linked to health problems, with effects ranging from seizures to agitation, aggression, acute psychosis and dependence. NPS users have frequently been hospitalised with severe intoxications; however, the toxicity,

carcinogenic potential and long-term adverse effects of many NPS are currently unknown. The purity and composition of substances containing NPS are also usually unknown, often resulting in unintentional polysubstance use and leading to increased health emergencies and fatalities (UNODC, n.d.). The popularity and availability of NPS is influenced by the general perception that they are 'low risk' legally and in terms of their adverse health effects. NPS are available online, both on the Surface Web and on the Dark Web, expanding the reach of their harmful effects. Reportedly, the low cost of NPS, paired with their high accessibility, makes them the substance of choice for some consumers, while their effects are vastly unknown. A global study on NPS found that products containing MDMB-FUBINACA (a type of synthetic cannabinoid) were linked to over 600 poisonings over two weeks, 15 of which were fatal (Sajwani, 2023).

NPS detection and monitoring

The first global NPS monitoring system – the EWA – was introduced in 2013 by UNODC and serves as a tool for effective and evidence-based policy responses based on monitoring, analysing and reporting global and regional NPS trends (UNODC, 2024). In the EU, the EMCDDA (now EUDA) and the European Union Agency for Law Enforcement Cooperation (Europol) first introduced the EU EWS in 1997, which plays a central role in supporting preparedness and responding to NPS at the national and EU levels. The EU EWS is the first step out of the three-step legal framework ((i) information exchange; (ii) risk assessment; (iii) decision-making), intended to enable the EU to rapidly detect, assess and respond to the health and social threats posed by NPS. The EWA and the EWS are interdisciplinary and multi-agency networks that act as information-exchange facilitators, and their effectiveness directly depends on close monitoring, good communication between stakeholders, timely responses to emerging drug threats and early detection. When an NPS is formally notified, it is closely monitored through the EWS for signals of harm, in which the EUDA uses event-based data, toxicovigilance, signal management and open-source information. NPS can be put under intense monitoring, during which risk communication is issued, including public health alerts and initial reports that may lead to a risk assessment being produced (EUDA, n.d.b). The information input on the EU EWS and EWA is paramount for the identification of the most prevalent and harmful NPS, which pose the greatest health risks, therefore supporting the prioritisation of substances for placement under international control and national legislative responses (UNODC, 2024).

Between 2017 and 2021, 110 NPS production sites in 9 European countries were reported to the EMCDDA, which is a significant increase from the 46 NPS production sites in 12 countries reported between 2013 and 2016. The biggest increase was observed in the Netherlands with 16 production sites reported between 2013 and 2016 increasing to 55 sites between 2017 and 2021, followed by Poland with an increase from 9 to 40 sites for the same period. Synthetic cathinone production sites accounted for the greatest number of reported production sites (total $n = 110$), with 47 sites reported. The second biggest group was GHB/GBL ($n = 34$), followed by miscellaneous drugs ($n = 15$), synthetic cannabinoids and phenethylamines ($n = 5$ each), ketamine and opioids ($n = 4$ each), indolalkylamines ($n = 2$) and arylalkylamines ($n = 1$) (EMCDDA and Europol, 2024a).

Producers of NPS continually change their chemical structures to hinder law enforcement's ability to track them. The illegal passing or smuggling of NPS through borders is among the core challenges faced by law enforcement, as traditional detection methods are unlikely to detect NPS due to the modifications to their structure. Due to their ever-changing structures and the time required to study and understand their metabolic pathways, NPS detection using traditional drug-detection methods at the workplace or in institutions (e.g. prisons) is further challenged (Al-

Asmari, 2024). Another obstacle for the control and detection of NPS is the unavailability of toxicological and analytical screening tests (Sajwani, 2023).

NPS online presence and distribution

The initial interest in the interaction between sites on the Surface Web and illicit drugs was predominantly focused on how online communities can share information on manufacturing and extracting substances and not so much on how the Surface Web could facilitate drug trading. The interest has shifted considerably in recent years due to the increased availability of NPS in web shops and lifestyle pharmaceuticals. NPS are largely perceived to be part of a legal grey area and often include products that are legally produced and sold in one jurisdiction but remain illegal in others (Childs et al., 2022).

Surface and Dark Web marketplaces (the latter also known as crypto markets) play a crucial role in NPS distribution. As mentioned above, producers constantly change the chemical structures of NPS to avoid detection, leading to the introduction of new, slightly modified substances, with the former ones vanishing from the markets. Wadsworth et al. (2018) studied the lifespan of individual NPS sold on Dark Web marketplaces and the lifespan of their vendors over a period of 12 months. The results of the study indicated that the total number of individual NPS and vendors on the analysed crypto markets increased by over 70 % for the individual NPS and over 90 % for the vendors during the research period. One fifth of the NPS were reportedly available for the full duration of the study, and around one quarter of the individual NPS were available for a few months. Almost half of the vendors were active for around two months, and only 4 % of them appeared during the full duration of the study (Wadsworth et al., 2018). These results support the idea that, although the individual substances change, NPS numbers increase and indicate growth in the public's interest in NPS, leading to further public health concerns. What remains unclear is how their presence online affects the drug chain and linkages to the organisation of criminal networks that may be tied to more traditional offline illicit drug activity. Data on wider offline activities, individuals and groups has not yet been clearly linked to the facilitation and ease of NPS distribution online, leaving a blind spot for LEAs, as the online presence and legality of NPS could indicate the involvement of entirely different groups of offenders or individual offenders, organisational and hierarchical structures, and consumers.

Nevertheless, NPS wholesalers, retailers and dealers often use logistics companies and postal services to ship the substances, leading to individuals unknowingly trafficking NPS. Smaller amounts of NPS are likely to be shipped by courier services and express mail, whereas larger shipments are likely to be delivered by sea and air. NPS may be concealed using similar methods to those used for the trafficking of controlled drugs (e.g. camouflage trafficking), mislabelling and declaring the NPS as common goods or chemical products, or routing NPS to European ports where the substances are not controlled to minimise the risks of interception. Spain and the Netherlands are currently reported to be the key European import entry points for NPS from China and India (EMCDDA and Europol, 2024a).

Legal landscape

The ambiguous legal status of NPS and the adoption of disparate legal instruments at the national and regional levels as a response to NPS are among the key challenges in controlling and detecting these substances. Generally, jurisdictions employ generic controls on groups of substances, individual substance listings or hybrid model controls in response to NPS. The generic model allows the control of entire groups of substances based on their core chemical

structures, and is implemented within both NPS-specific regulations and general drug regulations. This model is often employed by countries with highly dynamic NPS markets to enable the control of large numbers of related NPS without specifically naming them individually, and is characterised by frequent updates due to the chemical diversification of the substances and by continuous landscape monitoring. Member States that employ the generic model include Belgium, Germany and Poland. The individual listings model is characterised by classifying individual substances and placing them under national controls based on their psychoactive effects, considering the potential harm-to-therapeutic-value ratio caused by controlling the NPS. Examples of Member States employing the individual listings model include Czechia, the Netherlands and Portugal. The hybrid model combines individual listings and generic controls, enabling the control of both individual substances and entire NPS groups. The hybrid model is employed by Ireland and France (Neicun et al., 2022).

All three NPS control models have their respective benefits and limitations, and careful assessment is required when a national control model is selected. Generic controls allow the control of large quantities of NPS and facilitate the anticipation of future substances. However, the development of generic controls can be time-consuming due to the complexity of some NPS groups and the requirement to specify substitution patterns, necessitating the implementation of individual NPS listings while the generic controls are in development (United Nations, n.d.a). In terms of individual listings, each substance is assessed on a case-by-case basis, and individual substances can be added to national controls through either regular processes or rapid procedures, enabling their temporary or permanent control. This is the preferred approach for countries that are affected by a limited number of NPS and is characterised by lengthy procedures for listing NPS individually, leading to a lack of synchronisation between the emergence of NPS and their control. Furthermore, minor variations in the chemical structure of a listed substance are also not covered by legislation within the individual listings model. Overall, disparities between control models at the national level can further challenge the international tackling of NPS, with certain substances shifting in legality depending on the jurisdiction's controls. Further efforts are required to unify NPS controls at the European level to address the international dimensions of the issue (United Nations, n.d.b).

Current operational practices

First-hand insights into the operational practices of five European LEAs and one postal service were gained through written expert consultations, focusing on NPS prevalence, the criminal modus operandi of individuals in the NPS trafficking chain and detection capabilities.

Prevalence

The consulted practitioners unanimously agreed that the prevalence of crimes involving NPS has increased in the past five years. The NPS most frequently observed by the experts in the past five years were synthetic cathinones (50 % of responses; substances mentioned include 2-MMC, 3-MMC and 3-CMC), synthetic cannabinoids (37.5 %) and synthetic opioids (12.5 %), which corroborates the reports and statistics detailed above, especially considering the number of new opioids that were officially identified in 2023.

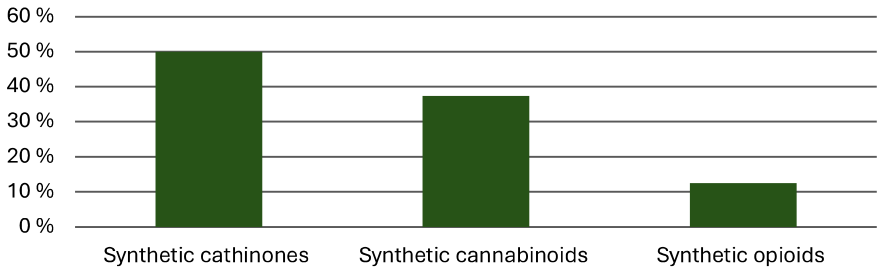

Figure 2.1. Most frequently observed NPS groups in the past five years

According to the practitioners, the Surface Web was reportedly the location where the most NPS were observed, followed by the Dark Web, international borders and other offline locations, while the Deep Web was the least frequently mentioned location for NPS. By contrast, none of the consulted experts indicated the Deep or Dark Webs as locations where they had observed the most illicit drug precursors. Instead, there was a higher response rate indicating offline locations. Furthermore, the experts specified that NPS were also observed on encrypted messaging applications and in local, national or international post offices. All consulted experts stated they had observed NPS being trafficked using postal or courier services.

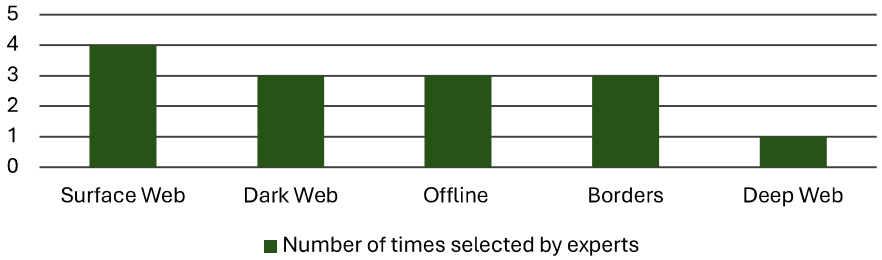

Figure 2.2. Online and offline locations where experts observed the most NPS

Modus operandi

The practitioners indicated that, from their experience, the groups of criminals dealing with NPS are different from the groups of criminals dealing with listed illegal drugs. They also stated that the strategies and modus operandi used by criminals dealing with NPS and criminals dealing with listed drugs vary. For instance, experts mentioned that criminals dealing with NPS avoid physical contact with consumers and other members of the criminal group by locating themselves online and often using cryptocurrencies to minimise the risks of detection and identification.

An example of an NPS modus operandi was given by one of the consulted LEAs in the context of synthetic cannabinoids ('spice') smuggled into prisons. It was stated that offenders were impregnating paper with spice and selling the sheets either as blank paper or as printed letters. According to the evidence gathered, the wholesale prices of the raw materials were relatively low (varying from EUR 850 for 250 g to EUR 1 900 for 1 kg), allowing the offenders to be efficient and consistent with the quality of the produced sheets. To impregnate the paper, the criminals were using between 5 g and 15 g of powder spice, diluted into a 250 ml bottle of acetone, yielding between 10 and 15 sheets. The offenders would sell the acetone with spice for approximately EUR 125 if 8 g of spice was used and for EUR 85 if 5 g of spice was used. The wholesale price of the impregnated paper was reported to be approximately EUR 425 for 25 sheets. The end-user price would vary, depending on the available supply in each

prison wing at a given time. Similarly, there were reports of paper impregnated with synthetic cannabinoids smuggled into Brazilian prisons, indicating the global dimensions of the issue (EMCDDA and Europol, 2024a).

NPS detection

The experts unanimously stated that NPS trafficking using postal or courier services is a frequent occurrence. This aligns with previous statements that NPS criminals avoid physical contact with consumers and other group members, thus dealing online and using postal or courier services to deliver substances. Some of the NPS detection methods for parcels the experts reported using within their organisations included X-rays, trace detectors and physical detection methods. However, the experts also reported that the current online methods of investigation for NPS appeared to be quite limited. They stated that they had no way to obtain information from encrypted platforms (e.g. WhatsApp, Telegram, Signal) and that their methods were not automated, requiring extensive and lengthy manual searches to detect NPS-related information online and on messaging platforms.

When asked which organisations and agencies are involved in the detection and investigation of NPS, the experts expanded that LEAs, customs authorities, national forensic institutes and laboratories, national crime agencies, regional organised crime units, and national technical-criminal and forensic expertise centres were among the key entities involved in NPS detection and investigation. However, the experts noted several issues that hindered their approaches to EU and international cooperation. They mentioned that differences in regulations can complicate data sharing between countries, as can ever-emerging technologies that, while useful, may not be adopted across the board. A challenge to EU and international cooperation mentioned repeatedly was the emergence and awareness of new substances, not yet under international control, across countries. One of the experts described a case where they first discovered the substance BMKGA by following a package intercepted in Germany that originated from China and was bound for their country. If the substance was not controlled in Germany, it would likely have reached its destination country and consumers. Additionally, some of the consulted LEAs were not part of the EU and indicated that their connection to the EU EWS would benefit the detection, monitoring and tackling of NPS at both the national and the international level.

To address these needs, the experts suggested starting with legislative harmonisation and adapting legislation to enable tighter cooperation between LEAs and postal services.

Conclusion

NPS pose a significant threat to Europe. The ever-changing chemical structures of these substances and the multitude of methods used to conceal them, along with their grey legal status and online availability, complicate their detection and thus their control. These factors also limit the acquisition of data on the health risks they might pose. The public health concerns are further elevated by the frequent unknown polysubstance consumption that occurs due to the combination of multiple NPS substances, leading to potential health crises. Corroboration between the reviewed literature and documentation and expert consultations is observed, as all sources report that synthetic cathinones are the most prevalent type of NPS in terms of seizures in Europe (EMCDDA and Europol, 2024a), with synthetic cannabinoids being a close second.

A multitude of areas should be improved to aid the detection and tackling of NPS, and to reduce their negative effects on public health. As stated above, many tests currently do not detect NPS, making them an attractive choice for people in prisons and individuals undergoing drug treatments. Further research is required on developing techniques and methods that can reliably detect a variety of NPS. Furthermore, the consulted practitioners reported less-than-optimal current capabilities for online investigation of NPS, which likely feeds into the present uncertainty over their facilitation and ease of distribution online. The current study therefore recommends more research into this area, both from an academic and from a law enforcement perspective. In addition, there is a need for synchronised efforts in the NPS legal landscape at the European level to ensure international continuity, timely and coordinated responses, and comprehensiveness of the established controls. This can be facilitated by shared intelligence on precursors and NPS, and by efforts to align national drug strategies and priorities holistically across Europe based on the flow of drugs across the continent, as opposed to keeping national perspectives isolated.

The trust between individuals and the healthcare system should be rebuilt, and healthcare professionals should be aware of the risks of individuals resorting to self-medication with more dangerous NPS when denied access to prescription drugs (Holborn et al., 2023), especially considering signs that the use of NPS among vulnerable populations may have increased (EMCDDA, 2022).

Additionally, the current research found that European countries not part of the EU face challenges in inputting and accessing data from the EU EWS, and the majority of their data is not fed into the system. This siloes intelligence gathering and further complicates tackling NPS at both the national and the European levels. Thus, considerations for involving more European countries should be made, and continuous improvement of international cooperation should be implemented to tackle the global dimensions of the NPS issue.

Acknowledgements

We are grateful to the experts who provided their valuable time for this work. This research was conducted as part of the ARIEN project, co-funded by the European Union. It is also funded by UK Research and Innovation under the UK government's Horizon Europe funding guarantee (grant number 10078198). For the purpose of open access, the authors have applied a Creative Commons Attribution (CC BY) licence to any author-accepted manuscript version of this paper arising from this submission.

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