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RESEARCH

Synthetic Drug Production in Belgium – Environmental Harms as Collateral Damage?

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The production of illicit drugs contributes to important environmental harms. In the European context, the production of synthetic drugs, particularly MDMA and amphetamine (and more recently methamphetamine), increasingly poses environmental challenges. The production of these substances in Europe is mainly concentrated in the Netherlands and to a lesser extent in Belgium. In this contribution we focus on the Belgian case, particularly in Flanders—the Belgian region where synthetic drug production has been more present. The goals of our analysis are 1) to document the presence of illicit synthetic drug production and dumping of chemical waste material in that region, 2) to explore the media coverage of environmental harms associated with those activities, and 3) to identify the range of reported environmental harms. We draw on data from the Belgian Federal Police and on an analysis of 289 news articles published in selected Flemish newspapers (2013–2020). The findings indicate that although there is an increasing trend in the presence of synthetic drug production and dumping sites in Belgium, the details on the nature and extent of environmental harms are often unknown. Besides difficulties around detecting certain types of dumping events, there are also important blind spots in terms of the monitoring of environmental hazards by law enforcement agencies and how that information is shared among the relevant actors.

Keywords: synthetic drugs; environmental harms; dumping; waste; production; Belgium

Introduction

Illicit drug markets are a source of myriad ramifications. They can generate or increase violence and drug-related crime, corruption, and political instability, and they can have detrimental effects on the environment (Babor et al. 2010; EMCDDA & Europol 2019). Previous research has presented the link between illicit drug production and environmental harms as a two-sided problem:[1] on the one hand there may be environmental harms resulting from illicit drug production per se, and on the other hand, some harms seem tied to supply control efforts, such as drug crop eradication programs (e.g., aerial fumigation of coca or cannabis plantations using herbicides) (Dávalos et al. 2011; del Olmo 1998; McSweeney 2015; Ortiz 2004; Salisbury & Fagan 2013). In addition, research in this area has pointed to other indirect effects: for instance, a displacement of production within and across countries, including to more ecologically vulnerable areas (e.g., tropical rainforests, national parks, and other protected areas) (McSweeney 2015; Salisbury & Fagan 2013). On itself, illicit drug production and processing has resulted in significant environmental damage (del Olmo 1998; EMCDDA & Europol 2019; McSweeney 2015; UNODC 2016).

Deforestation (including the clearance of protected areas and tropical forests), damage to soil and waterways as well as to local and endemic flora and fauna, and increased pressure on often fragile water resources are some of the key environmental harms documented in regions associated with the production of coca,

[1] While we focus on environmental harms related to production, we should note that there may be some degree of contamination of, for instance, waste and surface waters as a result of drug consumption (Boles & Wells 2010; Pal et al. 2013; Zuccato & Castiglioni 2009). Also the transportation of drugs from production to transit and destination countries may result in clearance of land—for instance to create clandestine landing areas for planes transporting illicit drugs and other environmental hazards (McSweeney 2015).

cannabis, and opium poppy (Álvarez 2007; Ashworth & Vizuete 2017; Bauer et al. 2015; Butsic & Brenner 2016; Carah et al. 2018; Chouvy & Macfarlane 2018; Gianotti et al. 2017; Mansfield 2019; Mills 2012; Salisbury & Fagan 2013; UNODC 2016). The various ecological impacts resulting from illicit drug production will vary depending on the substance being produced and the phase of production (del Olmo 1998).

In our analysis we pay attention to the environmental harms associated with synthetic drug production in Flanders (Belgium). In particular, we focus on amphetamine, methylenedioxymethamphetamine (MDMA), and methamphetamine, which are manufactured using drug precursors and other chemicals (EMCDDA 2015). Methamphetamine, produced in illicit laboratories, is the most commonly produced amphetamine-type stimulant (ATS) worldwide (Kates, Knapp & Keenan 2014; UNODC 2020). Regarding the EU market, it is estimated that the amphetamine, MDMA, and methamphetamine consumed in that region is almost exclusively produced in EU member states (EMCDDA & Europol 2019). The EU Drugs Strategy 2021–2025 (Council of the European Union 2020) noted the role of the EU as a producer of these types of substances and the environmental damages that result from that activity. One of the strategic priorities put forward in that document seeks to address environmental damage related to illicit synthetic drug production within the EU (Council of the European Union 2020). In the EU, production of synthetic drugs—particularly MDMA and amphetamine—is concentrated in the Netherlands and, albeit to a lesser extent, in Belgium (EMCDDA & Europol 2019). In addition, the available evidence points to an 'emergence of large-scale methamphetamine manufacture in the Netherlands and Belgium in recent years' (UNODC 2020: 43). As discussed in more detail below, production of these substances tends to be concentrated in the border region between the two countries. Within Belgium, this occurs primarily in the Flemish region.

In this contribution, we seek to 1) gather insights into the presence of illicit laboratories dedicated to synthetic drug production and dumping sites in Flanders (Belgium), 2) understand the extent to which environmental harms associated with those activities are featured in the domestic (written) media, and 3) identify the range of environmental harms that have been documented in that region. In the next sections, we provide some background information concerning the available evidence on the environmental harms associated with synthetic drugs production, on the particular developments in the Low Countries (i.e., Belgium and the Netherlands), and on the current monitoring practices of environmental hazards in the region.

The production of synthetic drugs and associated environmental harms

Synthetic drugs are manufactured using a number of different techniques and relying on various precursor chemicals.[2] While our analysis explores that phase of (chemical) production, it is worth noting that several precursors or pre-precursors are plant-based (Blickman 2009). For instance, sassafras oil and safrole-rich oils (i.e., key materials for production of precursors used in manufacturing MDMA) are extracted from tree species in South-East Asia (Blickman 2009). Ephedrine (i.e., a precursor used to produce methamphetamine) can be extracted from the ephedra plant, which is grown in central Afghanistan (among other countries) and seems to be on the basis of a booming methamphetamine-producing industry in that country (EMCDDA 2020a). Also these earlier steps of production, often based in the Global South, generate important environmental hazards (Kegö & Maïga 2014).

Illicit laboratories used for the production of synthetic drugs have been found in vehicles, domestic homes or apartments, motels, and other locations (Caldicott et al. 2005; Owens 2017), with different scales of production and sophistication (Al-Obaidi & Fletcher 2014). The mishandling of even small amounts of chemicals in the production of these substances can result in fires and explosions (Caldicott et al. 2005; Owens 2017), and both those involved in the manufacturing and bystanders run higher health risks from chemical exposure (Caldicott et al. 2005; Danks et al. 2004; Irvine & Chin 1991). An important negative environmental effect associated with synthetic drug production has to do with the large amount of toxic waste (gaseous, liquid, and solid) generated in that process.

Depending on the production method used, it has been estimated that the production of 1 kilogram of MDMA generates between 6–10 kg of chemical waste and the production of 1 kilogram of amphetamine generates threefold of that (between 20–30 kg of waste) (EMCDDA & Europol 2019). What is more, due to the control of certain precursor chemicals, some crime groups specialize in producing these precursors from pre-precursor chemicals (in so-called conversion laboratories) (EMCDDA 2019). This additional production stage generates yet more waste, so in practice the total waste generated with the production of 1 kg of MDMA or amphetamine may be higher.

[2] In Europe, the most frequently used precursors include benzyl methyl ketone (BMK) for amphetamine and methamphetamine, ephedrine and pseudoephedrine for methamphetamine, and piperonyl methyl ketone (PMK) for MDMA. These precursors are controlled at the European and international level (EMCDDA 2015).

Some of the waste generated in manufacturing synthetic drugs is left behind at the illicit laboratories, disposed in sewage systems and rivers, into the soil, burned, or dumped on the road or in other locations (Irvine & Chin 1991; Kates et al. 2014). Dumping waste into the soil or surface water might damage ecosystems, fauna, and flora, but also residents nearby might be at risk when drinking contaminated water or eating goods from contaminated soil (Boerman et al. 2017; Schoenmakers et al. 2016). When discharged into sewers or groundwater, which may occur in up to two thirds of the cases, it is possible that the waste will not be detected (Schoenmakers et al. 2016). Nevertheless, there are known cases of malfunctioning of small sewage treatment plants caused by the dumping of waste from amphetamine production (Emke et al. 2018). In addition, illicit synthetic drugs production may generate hazards for the vicinity of the sites as toxic vapors released during production may be vented outside and permeate into the walls and surfaces of the site (Scanga 2005), which could jeopardize the property and its reoccupation (Owens 2017). After detection, the clean-up of illicit laboratories and dumping sites is also a hazardous and costly task and requires the engagement of agents with specialized training in clean-up, transport, storage, and destruction of these chemical substances, and remediation of the sites.

Synthetic drug production: The Belgian and Dutch context

Dutch and Belgian criminal groups are 'the most important producers of synthetic drugs in the EU' (EMCDDA & Europol 2019: 159). In Belgium, most illicit laboratories and dumping sites are found in the border region with the Netherlands (i.e., in Flanders) (EMCDDA & Europol 2019). The 'use' of the border region and the increased Belgian-Dutch criminal network cooperation are no coincidence. The Belgian and Dutch drug markets and their criminal networks have been intertwined for many years (Colman et al. 2018).

To explain this Belgian-Dutch connection we need to consider earlier developments. In the 1990s, the Netherlands became one of the most important production countries of synthetic drugs.[3] To illustrate this, the amount of 'Dutch' MDMA tablets internationally seized increased from an estimated value of EUR 9.7 million in 1999 to EUR 25.7 million in 2001, and even EUR 38 million in 2002 (Van de Bunt, Kunst & Siegel 2003: 1). In 2006, it was estimated that 70% of the MDMA tablets seized worldwide, and worth between EUR 112–224 million, originated from the Netherlands (Van Laar et al. 2006). The Dutch government reacted in different ways, including by strengthening their investigative measures, establishing special teams to tackle this phenomenon, and reinforcing cooperation with China to restrict the illicit production of precursors for MDMA (PMK),[4] methamphetamine, and amphetamine (BMK),[5] leading to scarcity in the availability of the crucial precursors to manufacture synthetic drugs.

These developments and the response by the Dutch government also impacted neighbouring countries, including Belgium. First, Dutch criminal groups in the South of the Netherlands started to focus on synthetic drug production in the Belgian-Dutch border area (Spapens 2002). Criminal organisations spread (part of the) production process across the two countries because of opportunity reasons (e.g., finding suitable locations) or as a risk aversion strategy (i.e., using the border as an opportunity to make it harder for law enforcement officials to successfully start up investigations across countries with different legislative frameworks). Second, Dutch criminal groups increasingly relied on the Belgian market to purchase (pre-)precursors and other chemicals, such as acetone, due to the scarcity of these chemicals in their country (Boerman et al. 2017; Dienst Nationale Recherche 2012; Spapens 2006). In contrast to the Dutch policy, in Belgium there is no obligatory requirement to report suspicious transactions of large amounts of those chemicals.

With regards to dumping or discharging of chemical waste, the criminal groups active in the region have used different methods and have constantly adapted their way of working to decrease the risk of getting caught (Tops et al. 2018). For instance, in the Netherlands, an increasing number of production sites have been dismantled, although this has not been accompanied by an increase in the number of detected dumping sites (Cluster Synthetische Drugs Intel & Expertise 2020). Several reasons could help explain this. First, criminal groups involved in synthetic drug production may have become more creative in dealing with and concealing their waste, including by making more direct discharges into the soil, which are harder to detect. Second, they may be dumping more waste per dumping (so the number of dumping sites declines but the quantity disposed per dumping increases).

The clean-up of illicit laboratories and dumping sites is costly and entails risks. It is worth noting that in Belgium, the clean-up costs can be reclaimed from the criminal groups involved in setting up the production site. However, in multiple cases, the offenders involved are not caught (or the dumping site cannot be linked to a production site already detected). In those cases, if the production or dumping site is found on private

[3] But amphetamine in particular was already being produced on a large scale in the Netherlands since the 1970s (Tops 2018).

[4] 3,4-Methylenedioxyphenylpropan-2-one or piperonyl methyl ketone (MDP2P or PMK).

[5] Benzyl methyl ketone or 1-phenyl-2-propanone (BMK or P2P).

property, the landowner of the private property is responsible for paying the clean-up cost. If the production or dumping site is found on public property, the local authorities will bear the costs. Estimations of the costs related to cleaning up synthetic drug production and waste dumping sites are difficult to make given the overlap in costs between public and/or private organisations, diverse procedures in different regions, or differences in products used (Claessens et al. 2019). Nevertheless, Claessens and colleagues (2019) estimated the costs of dismantling and cleaning up 10 illicit laboratories, 26 dumping sites, and 6 storage places in Belgium (circa 2016) to amount to EUR 1,401,634.[6] The environmental costs (e.g., the costs associated with the remediation of contaminated soil by a private firm) were not included in this estimation though.

Current monitoring of environmental hazards from synthetic drug production in Belgium and at the European level

Currently, there are no country-wide standard protocols or regulations defining the procedures for dismantling and decontaminating a synthetic drug lab or dumping site in Belgium (Claessens et al. 2019). As such, the steps and actors involved may differ from case to case. Typically,[7] the Clan Lab Response Unit (i.e., a specialized laboratory service team, part of the Federal Police) is involved in the dismantling of synthetic drug labs (Claessens et al. 2019). During the dismantling, an inventory of all hardware and chemicals is made and samples are collected for analysis. The Civil Protection and/or a private contractor (i.e., specialized private waste disposal companies) take care of removing all hardware, chemicals, and waste from the site (Claessens et al. 2019). Beyond that, typically when an illicit synthetic drug lab or dumping site is detected, an environmental officer will draft an environmental report (personal communication with law enforcement agents 2020). This report is, however, not based on a systematic list of (quality-) indicators specific to the type of lab found (i.e., amphetamine, methamphetamine or MDMA production site), and the location and method of dumping (or discharge) are not necessarily recorded (personal communication with law enforcement agents 2020). As such, the soundness and comprehensiveness of the report will often depend on the drug-specific knowledge, expertise, and willingness of the individual environmental officer involved in each case.

At the European level, it is worth referring to the European Reporting Instrument on Sites related to Synthetic drug Production (ERISSP). This is a tool for the collection of standardized data on the number and characteristics of sites associated with the production, storage, and waste of synthetic drugs and precursors detected by national law enforcement agencies. National law enforcement officials have the opportunity to update the dataset and as such contribute to the monitoring of this phenomenon at the European level. At the moment, this monitoring focuses on the number of illicit laboratories and dumping sites and the products (substance and precursor) involved. The ERISSP is currently being revised with a view to improve data collection concerning the methods and location of dumping. The ERISSP tool is developed by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and Europol. In addition, the Directorate-General for Taxation and Customs Union (DG TAXUD) collects annual data on drug precursor seizures and stopped shipments in all Member States.

Methods

For the analysis we present here, we relied on two main sources of data: 1) data from the Belgian Federal Police (DJSOC) on the number of dismantled dumping sites, drug production sites, and storage sites, relative to amphetamine, MDMA, and methamphetamine; 2) written-press articles from Flemish newspapers with a focus on synthetic drug production and dumping in Belgium.

The statistical data were retrieved from the Federal Police, in particular from the central directorate for the fight against serious and organized crime. That data contains information on the number of dismantled illicit laboratories and dumping sites in Belgium. Synthetic drug production expanded from the Netherlands to Belgium from 2001 onwards, and in our analysis, we focus on the more recent developments—particularly on the available figures from 2011 until 2020.

The media dataset was identified and retrieved via Gopress Academic, an online database of Belgian press. We selected four newspapers: *De Morgen* and *De Standaard,* which have a wide distribution across the Flemish region of Belgium; and *Gazet van Antwerpen* and *Het Belang van Limburg*, which have a more targeted focus on the Flemish provinces of Antwerp and Limburg (which border the Netherlands), where

[6] Another study, focusing on the Dutch context, estimated the costs related to the clean-up of synthetic drug dumping sites including the costs of personnel, material resources, safety precautions, contracting out to private firms, cleaning, transport, storage, destruction, environmental recovery, reporting, and administration. Accordingly, the total cost associated with the clean-up of 19 dumping sites between 2003–2015 was estimated at EUR 222,137, with an average cost of EUR 12,453 per dumping site clean-up.

[7] Depending on the complexity of the case. For instance, the Clan Lab Response Unit might not be present at every scene of dumping cases (Claessens et al. 2019).

synthetic drug production has been particularly present (Colman et al. 2018). Given that the number of reported dismantled illicit laboratories and dumping sites substantially increased in 2013 (from 3 laboratories in 2012 to 12 laboratories in 2013 and from 2 dumping sites in 2012 to 13 dumping sites in 2013) according to the data collected from the Belgian Federal Police (see **Figure 1**), the time-frame applied to our searches on Gopress Academic comprised the period between January 2013 and September 2020. After a pilot phase where we tested different combinations of search terms, the final searches were run using the terms included in **Table 1**. The criteria for inclusion of the articles were the following: 1) the article has a focus on synthetic drugs in general or specifically on amphetamine, methamphetamine, MDMA; 2) in relation to the production or dumping of—chemical waste from—those substances; 3) in Belgium.

Table 1: Overview of the search strategy.

Keywords used in the searches[8]	Initial number of results	Final number of results (after removing duplicates and irrelevant* articles)
drugs AND dumping 'drugs lab' 'drug waste' amphetamine AND dumping amphetamine AND lab amphetamine AND waste methamphetamine AND dumping methamphetamine AND lab methamphetamine AND waste MDMA AND dumping MDMA AND lab MDMA AND waste	482	289

Note: * Examples of irrelevant articles include those covering substances other than synthetic drugs (e.g., cannabis, tobacco) that did not focus on the Belgian context (but rather on the Netherlands, for instance) or that were not about the actual production or dumping of those substances (e.g., some cases of articles reporting on a movie or TV show).

The final set of articles included for analysis (N = 289) was brought into NVivo (i.e., a software package for qualitative data analysis). The first two authors of this publication discussed and drafted the coding structure, which served as the basis for the analysis of this data. We included two broad codes: 1) a 'general' code, with sub-codes capturing more specific information concerning 'trends on synthetic drug production and dumping', 'costs of cleaning up laboratories or dumping sites', 'citizen-led initiatives', 'court proceedings and sentencing',[9] and 'other'; and 2) a code relative to the media reporting on concrete 'incidents' or cases involving synthetic drug production or dumping of chemical waste. Each case was identified per year and ordered chronologically. The same structure of sub-nodes was applied to analyse each 'incident' and included data on 'main substance', 'quantity of substance found', 'site location', 'type of property', 'detection', 'costs of cleaning up', 'harms', 'site remediation'.[10]

When reporting on the characterization of the incidents involving the production or dumping of the substances considered here, we grouped the articles per 'case'. As an example, all articles (n = 5) published about the detection of an illicit synthetic drugs lab in the municipality of Hechtel-Eksel at the end of January 2019 were grouped and coded as belonging to case '2019_2'. This allowed us to have a more complete overview of what was reported about the same event. When referring to the volume of news articles depicting a particular issue, we explicitly indicate that the figure reflects the sum of news articles (and not of cases).

Limitations

The scope of our contribution is limited to Flanders (Belgium) and to the time-period indicated in the preceding section. Synthetic drug production is of course a complex and boundless phenomenon, and in the particular case of Belgium, there is an important intertwinement with the Dutch market and with

[8] In the original searches in Dutch the following terms were used: drugs AND dumping; drugslab; drugsafval; amfetamine AND dumping; amfetamine AND lab; amphetamine AND afval; methamfetamine AND dumping; methamfetamine AND lab; methamfetamine AND afval; MDMA AND dumping; MDMA AND lab; MDMA AND afval.

[9] While the data concerning court proceedings and sentencing was coded to this node, we do not discuss this particular aspect in this paper as it goes beyond the scope of our analysis.

[10] An additional layer of codes was added for each of these aspects (e.g., with regards to 'harms', the relevant data was then also coded to more specific nodes on 'environmental', 'human', 'other' harms).

criminal networks based in the Netherlands. Future studies may be interested in exploring that context in more depth, and we hope our analysis may offer a starting point for further comparative analysis. Likewise, expanding the gaze to earlier phases of the production/supply chain in other settings could help build a more comprehensive and context-sensitive overview of the range of environmental harms associated with synthetic drug production.

The data used in our analysis has a number of limitations. With regards to the police reports we drew on, it is worth noting that these are based on the number of dismantled illicit laboratories and dumping sites (i.e., registered offences) being just one of the many indicators to report trends in drug production (and related harms).[11] Caution is required when interpreting these findings given the fact that 1) these figures reflect police activity and priorities in a particular country/region and 2) these are likely an under-estimation of the actual number of illicit laboratories and dumping sites—a point we return to in our analysis and discussion of the findings. Some activities, such as direct discharges of waste materials into the soil, are likely to remain undetected and therefore are not captured in police statistics or in media reports. Furthermore, we are also aware that the media reports are likely not the most comprehensive or systematic source of information—despite arguably providing relevant contextual data about the incidents involving illicit synthetic drug production or dumping. Nevertheless, we were also interested in learning more about whether and how there was a consideration of environmental harms in the news reporting about those incidents—as one indicator of the attention given to the topic in public discourses. Ease of access to the data (during the Covid-19 pandemic) was also a factor that informed our selection of these data sources.

Results

Insights into the presence of illicit laboratories and dumping sites of waste materials associated with synthetic drug production in Belgium

In general, in Belgium, the number of discovered illicit laboratories and dumping sites, as reported by the Federal Police, has been increasing over the years (although with some fluctuation)—see **Figure 1**. The highest number of illicit laboratories and dumping sites were reported in 2018 and 2019. Until mid-October 2020, the Federal Police already discovered 19 illicit laboratories, 7 storage places, and 14 dumping sites (data obtained from DJSOC 2020, see **Figure 1**). Most of the reported dismantled illicit laboratories were amphetamine labs, while most of the dumping sites contained (residues of) MDMA and were located in Flanders (DJSOC 2020).

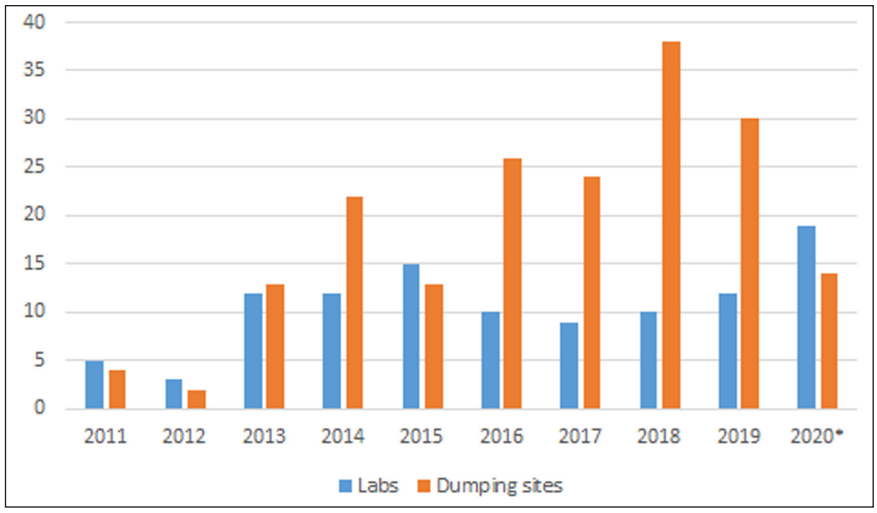

Figure 1: Number of dismantled illicit laboratories (for synthetic drug production) and dumping sites in Belgium (2011–2020).**

Source: Federal Police, DJSOC 2020.

Note: * Figures until mid-October 2020. ** The reporting on dismantled illicit laboratories only includes cases involving the production of amphetamine and MDMA.

[11] We should also note that while the police reports concern the number of dismantled illicit laboratories and dumping sites in the whole country, we have selected Flemish newspapers for our media analysis given that most illicit laboratories and dumping sites are found in that region.

Figure 1 does not include the number of dismantled methamphetamine labs. Production of methamphetamine only became apparent in Belgium starting from 2018 onwards. Between 2018 and 2020, nine methamphetamine labs were discovered (five of them in 2020 alone).

Between 2013–2020, 69 cases of dumping were reported in the Flemish media (in 90 news articles), and 38 cases involving the detection of an illicit lab for the production of synthetic drugs were covered (in 57 news articles). In line with the police reports, 2018, and subsequently 2019, were the years with the highest number of media reported cases involving dumping of chemical waste or production of synthetic drugs—as noted in **Figure 2** below. Several news articles also highlighted the increasing trend in terms of production and dumping, in particular in the border region between Belgium and the Netherlands.

Key features of the cases of illicit laboratories and dumping sites reported by the Flemish media

The news articles often reported on the actors who detected the dumping sites or the illicit laboratories. Illicit laboratories were more commonly discovered by the police (20 cases). With regards to dumping sites, it seems these were most often identified by passers-by, who reported on the presence of suspect or unusual materials to the responsible authorities (20 cases). According to the media coverage on this, the public authorities have also taken steps to further encourage this type of reporting by their citizens. For instance, one of the articles reported on an information evening about illicit drug production organized by the Public Prosecutor's office in Limburg, where several experts talked about how one could recognize potential illicit laboratories or dumping sites (Flemish newspaper *Het Belang van Limburg*, 8 June 2019). An anonymous drug hotline has also been set up in that province to allow for reporting illicit production or dumping sites:[12]

> The anonymous drug hotline is the result of a months-long brainstorming session between Belgian Limburg and the Netherlands to do something about the drugs problem in the border region. "The aim is to inform citizens about and involve them in this problem, while at the same time making it clear to criminal organizations that they are now more likely to be caught. We will also be putting up posters in the coming months to raise awareness and willingness to report among the population" (Flemish newspaper *De Standaard,* 17 April 2019, own translation).

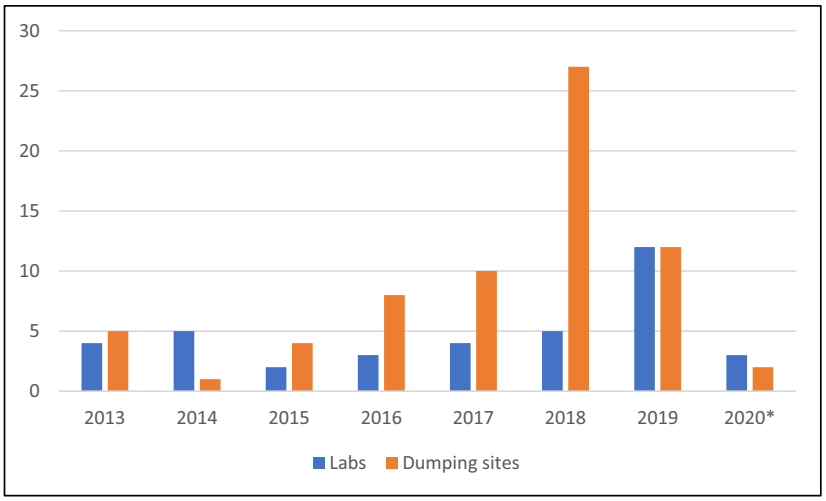

Figure 2: Cases of detected illicit laboratories (for synthetic drug production) and dumping sites reported by the Flemish media (2013–2020).

Note: This Figure presents the number of cases reported and not the absolute number of news articles (i.e., articles about the same incident were grouped together (as indicated in the Methods section), and it is this number that is shown here).

* For 2020, this only includes reporting until September.

[12] In addition, two other news articles covered calls from politicians regarding the creation of a similar hotline in another region of the country (i.e., Kempen).

According to the news articles, and in line with the police reports, these illicit laboratories were set up for the production of amphetamine (18 cases), MDMA (8 cases), and methamphetamine (3 cases). The latter seemed to constitute a recent development, as the first case dates to 2018, when the police identified an illicit production site for both amphetamine and methamphetamine. A year later, the first lab exclusively set up for the production of methamphetamine was found and described as follows: 'in a remote former pig farm in Wuustwezel,[13] the federal judicial police dismantled a drug lab where crystal meth, the synthetic hard drug methamphetamine, was being made' (Flemish newspaper *De Standaard*, 13 June 2019, own translation).

In relation to the substances discovered in dumping sites, less detailed information could be found, and in most cases the news articles referred only to 'chemical waste' (57 cases). The news articles included some indication of the amount of waste found at the dumping sites (this was not as often reported with regards to illicit laboratories). Nevertheless, the reporting of quantities found was not done in a systematic manner, making it difficult to draw meaningful comparisons across cases. We found reports of a range of 2 to 100 barrels (of different volumes) left at the dumping sites, and these were not always full—in some cases only traces of waste were retrieved at the sites—but there were also estimates of 70 to 11,000 liters of dumped waste (per case).

Another aspect reported in the news articles concerned the location of dumping sites. The waste from synthetic drug production was abandoned at the side of or near roads (22 cases); in rivers or waterways (10 cases); in forests (9 cases); in urban areas—for instance, in residential areas (e.g., at the driveway of a house in one case); at a central square,; near a local fast-food chain restaurant, etc. (7 cases); at industrial sites (4 cases); and across a range of other locations (16 cases, including in parking lots, in fields or meadows, etc.). In several cases, the chemical waste was left in a vehicle (17 cases). Illicit laboratories were primarily found indoors, in houses or apartments (11 cases), farms (8 cases), warehouses (6 cases), and several other types of properties (10 cases, including at a strawberry greenhouse, at a tavern, and at a former restaurant, among others).

Media reporting on the harms associated with synthetic drug production and dumping in Flanders

We found references to harms associated with synthetic drug production and dumping of chemical waste in at least 47 news articles in our dataset. Often these were general mentions to 'environmental damage'. The full extent of the environmental harms incurred does not seem to be known. This may be related to difficulties in detecting the sites. In one of the articles, a spokesperson for the Public Prosecutor's office in Limburg estimated that 'only 20% of the dumpings are discovered by the police (Flemish newspaper, *De Standaard*, 17 April 2019, own translation). But also, when detected, having an accurate and comprehensive understanding of the extent of the harms might be challenging. A police commissioner affiliated with the Federal Police noted that 'those barrels only contain a part of all that waste. You may even say that the damage is not too bad, because the hazardous substances are packed. Most of the waste ends up in nature, waterways or sewers. Many discharges simply remain under the radar' (Flemish newspaper *De Standaard*, 9 July 2016, own translation). That police commissioner later added that 'the finds of dumped barrels are just the tip of the iceberg. Nobody knows the scale of the entire problem and therefore the danger to the environment or health' (Flemish newspaper *Het Belang van Limburg*, 24 September 2016, own translation).

In the media reporting about the discovery of dumping sites or illicit laboratories, we found some identification of environmental, human, and other harms—see **Table 2**. In 14 other cases, the news articles explicitly noted that there was no immediate danger (for the environment or human health or other) associated with the dumping site (13 cases) or the illicit lab (1 case).

With regards to environmental harms occurring as a result of the dumping of chemical waste associated with the production of synthetic drugs, soil pollution was the most common issue. For instance, in one of the articles a fireman was cited saying that 'we suspect that 2500 liters of strong acids and bases have seeped into the ground' (Flemish newspaper *De Standaard*, 27 January 2018, own translation). In another case it was similarly noted that 'some of the chemicals, including ammonia, were released into nature and also penetrated the soil' (Flemish newspaper *Het Belang van Limburg*, 1 April 2016, own translation). Contamination of waterways was also reported in relation to two cases. In terms of direct harms for human health, we identified one case where passers-by suffered severe burns from coming into contact with chemical waste—the incident was described as follows: 'three children from Kruibeke and their monitor suffered severe burns yesterday. They rode their bikes through a pool where chemical products had been dumped, presumably

[13] Wuustwezel is a municipality located in the province of Antwerp.

Table 2: Harms reported by the Flemish media in relation to dumping sites and illicit laboratories.

Type of incident	Broad type of harm	Specific harm (as reported)	Number of cases
Dumping site (69 cases)	Environmental harms	Soil pollution	8
		Water contamination	2
	Human harms	Severe burns (passers-by, including 3 children)	1
	Other harms	Property (vehicle set on fire)	2
Illicit lab (38 cases)	Environmental harms	Soil pollution	1
		Water contamination	2
	Human harms	Injuries (unspecified)	1
		Death (3 people)	1
	Other harms	Property (fire, explosion inside a house)	3

the remains of a drug lab' (Flemish newspaper *Gazet van Antwerpen*, 12 August 2015, own translation). Two other cases involved the destruction of vehicles, such as 'truck full of drug waste dumped and set on fire' (Flemish newspaper *Het Belang van Limburg,* 21 March 2019, own translation).

We also found references to environmental, human, or other harms resulting from synthetic drug production sites. Soil and water contamination were noted in three instances. In one of those, the news article mentioned that 'soil samples from the Public Waste Agency of Flanders (OVAM) have shown that the soil has become heavily polluted in the backyard of a house' (Flemish newspaper *Het Belang van Limburg*, 20 September 2014, own translation). Damages to property as a result of explosions or fire at the site of production were also reported. In one case, several buildings were burned down: 'nine industrial buildings in the Kieleberg industrial zone in Bilzen went up in flames. Investigation by the federal judicial police of Limburg has now revealed that the fire was caused by an explosion in a drug lab housed in one of the halls' (Flemish newspaper *Het Belang van Limburg,* 5 December 2019, own translation). There were also two cases where human harms were reported: in the first case, one individual was injured as a result of an explosion at a lab built in a basement of a house; in the second case, three individuals died at the lab. The latter was reported as follows: 'the "workers" at the drug lab in Hechtel-Eksel did not die after an explosion, but after inhaling poisonous gases' (Flemish newspaper *Gazet van Antwerpen,* 30 January 2019). One other news article offered additional details: 'the three victims – two young men aged 25 and 23 from Eindhoven and an Armenian aged 22 from Valkenswaard – are the first fatalities occurring in a synthetic drug lab in our country' (Flemish newspaper *Het Belang van Limburg*, 2 February 2019).

In 10 cases concerning dumping sites, the news articles also discussed site remediation efforts.[14] In some of those cases, the contaminated soil had to be removed, as noted in the following article: 'the barrels were scattered along the side of a forest road and caused soil pollution. The municipal technical service has excavated the polluted soil' (Flemish newspaper *Het Belang van Limburg*, 18 November 2013, own translation). In a few other cases, the waterways had to be purified, for example: 'the stream was dammed as quickly as possible so that the hazardous substances would not spread further into the environment. Limestone was also added to the water stream to optimize its acidity' (Flemish newspaper *De Standaard*, 12 July 2019, own translation). The costs incurred with regards to site remediation or clean up were also discussed in a few articles. A specialized disposal firm (SGS Ewacs) was cited explaining that

> the price depends on the products found. It can range from EUR0,7/kg to EUR 2/kg if it concerns very dangerous and corrosive substances. The cost price for clearance of one dumping site with twenty barrels of 220 liter of hazardous substances therefore fluctuates around EUR10.000. That's when the barrels can be easily removed. If there are leaks or if waste has to be pumped away, it will of course be more expensive (Flemish newspaper *Het Belang van Limburg*, 24 September 2016, own translation).

[14] This figure only comprises the cases where an actual remediation action was taken or considered. The general cleaning of sites (e.g., removing waste or lab materials) is not included here.

As noted earlier, the local municipalities bear these costs when the sites are located in public areas, which raised some critique from representatives of border municipalities who considered it a heavy and costly burden due to the disproportionate concentration of synthetic drug production in their region. As an example, one of the articles put forward an estimate for a city in the province of Limburg, near the border with the Netherlands: 'for Lommel alone, where drug waste is regularly dumped, it would amount to roughly EUR500.000 on an annual basis' (Flemish newspaper *Het Belang van Limburg*, 10 September 2018, own translation).

Discussion

Belgium and the production of synthetic drugs: More production, more waste, more harms

Large-scale production of MDMA and amphetamine takes place in Europe (EMCDDA & Europol 2019). Belgium is, besides the Netherlands, one of the main producing countries of those substances. Both the official data and media reports point to a growing number of dismantled illicit laboratories and dumping sites, from 2013 onwards, with peaks in 2018 and 2019. Most of these discovered illicit laboratories were set up to produce amphetamine, while most of the dumping sites contained residues of MDMA—although the media mainly referred to it in more generic terms ('chemical waste'). The synthetic drug market continues to evolve, and there are growing concerns that methamphetamine production is taking place in both the Netherlands and Belgium as well (EMCDDA & Europol 2019; UNODC 2020). In our media dataset we identified three recent cases of illicit laboratories dedicated to the production of methamphetamine in Belgium (from 2018 onwards). In terms of location, a variety of options seem to have been used by criminal groups engaging in synthetic drug production in Belgium (e.g., houses and apartments, farms, warehouses) and dumping (e.g., mainly in vehicles at the side or near roads, in urban areas, but also in forest, waterways, etc.).

The production of synthetic drugs generates tons of waste. Generally speaking, as this will also depend on the methods used, the production of amphetamine generates more waste than the production of MDMA. It has been estimated that the production of amphetamine and methamphetamine consumed in the EU in 2017 may have generated somewhere between 1240–1860 tonnes of waste, while with regards to MDMA the quantity of waste produced may have been about 53–88 tonnes (EMCDDA & Europol 2019). The dumping of these waste products may result in environmental damage, health risks, and high clean-up costs. Based on the Flemish media accounts, soil pollution and water contamination were the key environmental harms resulting from synthetic drug production and dumping of chemical waste, although more precise information on the extent and potential (remediation) costs of those hazards is lacking. What is more, the discovered dumping sites are only the tip of the iceberg, as significant amounts of waste might remain undetected following discharges into sewers or groundwater (Schoenmakers et al. 2016). To this extent, Emke and colleagues (2014) indicated that the chemical waste from illicit synthetic drug production will result in a specific chemical fingerprint that may be tracked in wastewater, which could lead to the identification of drug production or synthesis waste disposal in a specific wastewater area (Emke et al. 2018), which may be useful to get a more complete assessment of the impact of the phenomenon. In 2020, one could expect to see a decrease in the total number of discovered dumping sites (in contrast to the number of illicit laboratories) in Belgium—similarly to what has already been observed in the Netherlands (Cluster Synthetische Drugs Intel & Expertise 2020).

Raising awareness and encouraging citizens to report suspicious actions related to synthetic drug production

Our analysis suggests that most dumping sites have been discovered by chance by passers-by who reported on the presence of suspect or unusual materials to the responsible authorities. Law enforcement officials need the assistance of the public in the detection and reporting of this phenomenon. The Public Prosecutor's Office in one of the border regions (i.e., Limburg) has therefore taken several initiatives to raise awareness among the citizens about drug production and related harms and to increase this type of reporting, including setting up an anonymous hotline through which citizens can report suspicious cases related to drug production or dumping sites. Since its establishment in April 2019, the anonymous hotline has received 211 reports (up until mid-March 2020), and 27% of those reports led to further criminal investigations and the discovery of three illicit laboratories in Limburg (De Hauwere 2020). Intensifying and extending these initiatives to raise awareness among citizens about the harms (for their health, the environment) related to synthetic drug production and the need to report suspicious activities could help law enforcement officials in discovering more illicit laboratories and dumping sites in the future.

Limited accounts of environmental harms in the media

In our analysis we were interested in learning more about the extent to which environmental harms are featured in the media reporting about illicit laboratories and dumping sites. Although the news articles paid attention to the phenomenon and presence of synthetic drug production and dumping sites, they mainly described the circumstances of the incident: who detected the site, its location, and (to a lesser extent) the substances produced/found. The reporting on environmental harms was rather generic. Only with regards to 10 cases (out of 69 reported) involving dumping sites and 3 other cases (out of 38) focusing on illicit laboratories was there some consideration of the specific environmental harms involved (i.e., references to soil and water pollution). At the same time, it is plausible that at the time the news articles were written a full account of the extent of environmental harms may not have been known (i.e., if samples of potentially contaminated surfaces/materials were sent for further testing). However, this does not seem to be merely an issue of media reporting.

The need to improve the monitoring of environmental harms related to synthetic drug production

In order to tackle this phenomenon in an adequate way, there is a need to sufficiently and systematically monitor it, as highlighted in the latest EU Drugs Strategy 2021–2025 (Council of the European Union 2020). Monitoring provides an opportunity to understand the scope and nature of the phenomenon. It could inform future policy and operational responses and support interventions addressing the environmental-related threats stemming from the production and dumping of synthetic drugs. Today, our understanding of the magnitude of the environmental damages is limited. In part this may be due to challenges in detecting the illicit laboratories and dumping sites: only a portion are discovered by the police. As discussed earlier, criminal groups also take steps to reduce the risk of detection by being creative in disposing their waste. As a result, only a part of the waste material is likely to be found—and an important part of the waste generated in the production process is discharged in nature, sewage, the soil, possibly remaining undetected. Getting insights into the latest trends and modus operandi of criminal groups could lead to a better detection of dumping sites or other ways of dumping or disposing waste. In this regard, we already indicated earlier that wastewater analysis could be a useful complementary tool to monitor synthetic drug production (EMCDDA 2020b). Therefore, a systematic monitoring of synthetic drug production through wastewater analysis, as well as soil and groundwater testing, combined with timely precursor chemicals monitoring through a precursor Early Warning System for new precursor chemicals, could not only gradually close this knowledge gap, but also may add to better understanding and strategic anticipation by law enforcement agencies and a clearer picture on possible environmental harms.

However, beyond the difficulties around detecting these sites, even in those cases where environmental harms are identified, there seem to be shortcomings in terms of how these are monitored and how that information is shared among the relevant actors. For instance, it would be of added value to introduce specific guidelines to the drafting of environmental reports following the detection of an illicit synthetic drug lab or dumping site. Such guidelines could include quality standards for the analysis of (possibly contaminated) samples and a register of the location and type of dumping (dumping or discharge), which are not necessarily captured at the moment. This type of data would allow for a more accurate and systematic environmental risk assessment. Enhancing information exchange between law enforcement (police and public prosecutors), environmental officers, national institutes responsible for analysing and reporting synthetic drug production cases, and private actors could also contribute to a more consistent monitoring of the environmental harms and help raise awareness about these harms, both at the national and European level.

Conclusion

Belgium has an important role in terms of synthetic drug production in Europe. That production has negative implications—not least from an environmental perspective. In fact, the illicit production of these substances generates significant amounts of waste, which are discharged or dumped in public and private locations, contributing to the pollution of waterways and soil, among other hazards. The purpose of this analysis was to draw on media accounts and police reports to shed light on the extent to which synthetic drug production and dumping of chemical waste was taking place in Flanders (Belgium) and to identify negative environmental impacts associated with those activities.

We were able to confirm the increasing trend in terms of the presence of production and dumping sites in Flanders. Our analysis also suggests that the population at large is a crucial actor in detecting dumping sites, which underlines the importance of raising awareness to reduce risks when passers-by come in contact

with these waste materials, while at the same time ensuring they are able to recognize and report their findings. In relation to the actual environmental harms associated with synthetic drug production in Belgium, many unknowns remain. The media provided some contextual information and characterization of the illicit synthetic drug production and dumping sites, but the details on the nature and extent of environmental harms were often not reported. However, this does not seem to be merely an issue of news coverage, which also has inherent limitations.

Besides difficulties around detecting these sites, there may also be important blind spots/weaknesses in terms of systematic monitoring and information-exchange concerning environmental hazards among law enforcement actors (such as police, Public Prosecutors), national institutes responsible for reporting these cases, local government, and private companies. At the European level, the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and Europol are expanding their ERISSP tool to improve data collection concerning the methods and location of dumping. This and other efforts are needed to help improve our knowledge and raise attention to the importance of data collection about environmental hazards.

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Competing Interests

The authors have no competing interests to declare.

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