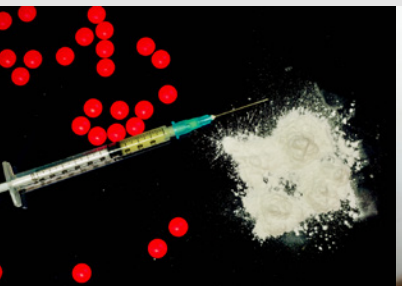
European Monitoring Centre
for Drugs and Drug Addiction

RAPID COMMUNICATION

Drugs in syringes from six European cities

Results from the ESCAPE project 2017

May 2019

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ESCAPE at a glance

Objectives of the project

Available data on the substances injected by users are based on self-reports collected in drug treatment registries or ad-hoc surveys. While these data are informative, they are often available only after some delay and are not analytically confirmed. Moreover, little is known about people who inject drugs that are not reached by drug services. The ESCAPE (European Syringe Collection and Analysis Project Enterprise) project seeks to complement existing data on substances injected by users, by providing timely and local information derived from the analysis of the residual content of used syringes.

A novel approach

A group of European researchers has developed an innovative method to obtain information on injected substances by chemically analysing the residual content of used syringes. For this study, syringes were collected from the bins of street automatic injection kit dispensers and at harm-reduction services in a network of six sentinel European cities: Amsterdam, Budapest, Glasgow, Helsinki, Lausanne and Paris. The contents of 1 521 used syringes were analysed in five laboratories using chromatographic and spectroscopic methods.

Main results

- Injected substances vary between and within cities.
- Traces of stimulants (cocaine, amphetamines and synthetic cathinones) were found in a high proportion of the syringes tested in each of the cities. This may indicate a high prevalence of stimulant use among people who inject drugs.
- Injection of opioid substitution medications, most notably buprenorphine, as well as benzodiazepines and other medications is common in some cities.
- Half of the tested syringes contained residues of two or more drugs, which may indicate that people who inject drugs often inject more than one substance. The most frequent combination was a mix of a stimulant and an opioid; benzodiazepines were often found in syringes that also contained traces of opioids.

Main limitations

- A high number of syringes containing residues of stimulants could reflect the higher frequency of injecting among stimulant users, rather than a high prevalence of stimulant use among people who inject drugs.
- Drugs found in syringes may originate from blood drawn into the syringe during an injection. This would indicate that the user had consumed the drug prior to the injection, possibly through other modes of administration.
- It was not possible to distinguish a syringe containing residues of multiple drugs that has been used once, from a syringe that has been reused by one user or used by several for different drugs.

Key issues

- The ESCAPE approach provides local and timely information that can be used for city-level monitoring and interventions.
- This study documents the substances and combinations of substances that were injected in the participating cities.
- The injection of stimulants has implications for the risk of blood-borne and sexually transmitted infections such as HIV and hepatitis B and C viruses.
- The injection of multiple substances elevates the risk of adverse health consequences and overdose deaths.

What's next?

Future campaigns will aim at collecting syringes from other settings and will allow the monitoring of trends over time. The network will be expanded to include more cities, in order to provide a more representative picture of the European situation and to advance knowledge on local injecting practices.

Study rationale and methods

While evidence from drug treatment centres suggests that the prevalence of injecting drug use is declining in the European Union (EMCDDA, 2015), the burden of disease associated with injecting remains high (Degenhardt et al., 2017). The risk of overdose death and infectious diseases associated with this mode of administration is also high. The injection of stimulants — including cocaine and synthetic cathinones — has been linked to increased risk of HIV and HCV transmission, through increased frequency of use and sharing of injecting paraphernalia (Giese et al., 2015). Knowledge of what substances are being injected in a city or country is necessary to guide prevention strategies and plan the provision of treatment, as well as to inform law enforcement agencies. Furthermore, identifying associated risk factors, such as reuse and sharing of injecting material, is useful to assess and improve harm-reduction interventions

Available data on the substances injected by users are based largely on self-reports collected in drug treatment registries or ad-hoc surveys (DRUCK Study group et al., 2016). Data from drug treatment centres collated at the national level show that the majority of people entering treatment who report injection as their main mode of administration identify an opioid (usually heroin) as their primary problem drug (see Table 1). While these data are useful, they are generally available only after some delay. Moreover, people who inject drugs may not wish to disclose the substances they inject or may not be aware of the composition of the substances they inject. Little is known about people who inject drugs that are not reached by drug services. To address such gaps in the data, a group of European researchers developed an innovative method to obtain information on injected substances by analysing the residual content of discarded syringes collected from the bins of street automatic injection kit dispensers (AIKD) or at harm-reduction services (Lefrançois et al., 2016; Néfau et al., 2015; Péterfi et al., 2017). The current study draws on this innovative methodology.

This publication provides an overview of the main findings of the European Syringe Collection and Analysis Project Enterprise (ESCAPE) 2017 campaign. ESCAPE was established in 2017 by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) with a network of six sentinel European cities: Amsterdam, Budapest, Glasgow, Helsinki, Lausanne and Paris. It aims to identify which drugs are injected in the six cities by analysing the content of used syringes.

TABLE 1

Number and percentage of drug treatment entrants reporting current injecting by self-reported primary drug and estimated population size of current injectors aged 15-64, in countries hosting ESCAPE sentinel cities

	Finland	France	Hungary	Netherlands	Scotland (United Kingdom)
Heroin	4 (1.2 %)	1 257 (58.8 %)	69 (35.9 %)	36 (66.7 %)	1 478 (95.4 %)
Buprenorphine	201 (60.7 %)	266 (12.4 %)	0 (0.0 %)	0 (0.0 %)	8 (0.5 %)
Methadone	0 (0.0 %)	10 (0.5 %)	11 (5.7 %)	0 (0.0 %)	1 (0.1 %)
Fentanyl and its derivatives	2 (0.6 %)	3 (0.1 %)	0 (0.0 %)	0 (0.0 %)	1 (0.1 %)
Other opioids	23 (6.9 %)	294 (13.7 %)	7 (3.6 %)	3 (5.6 %)	2 (0.1 %)
Cocaine	0 (0.0 %)	243 (11.4 %)	2 (1.0 %)	5 (9.3 %)	44 (2.8 %)
Amphetamines	91 (27.5 %)	17 (0.8 %)	31 (16.1 %)	3 (5.6 %)	5 (0.3 %)
Methamphetamines	1 (0.3 %)	1 (0.0 %)	0 (0.0 %)	1 (1.9 %)	0 (0.0 %)
Cathinones	4 (1.2 %)	17 (0.8 %)	0 (0.0 %)	0 (0.0 %)	0 (0.0 %)
MDMA	0 (0.0 %)	1 (0.0 %)	13 (6.8 %)	0 (0.0 %)	0 (0.0 %)
Other stimulants	3 (0.9 %)	10 (0.5 %)	25 (13.0 %)	1 (1.9 %)	0 (0.0 %)
Benzodiazepines	1 (0.3 %)	4 (0.2 %)	0 (0.0 %)	0 (0.0 %)	2 (0.1 %)
Others	1 (0.3 %)	16 (0.7 %)	34 (17.7 %)	5 (9.3 %)	9 (0.6 %)
Total	331	2 139	192	54	1 550
Estimated number of people who inject drugs and prevalence per 1 000 population aged 15-64	15 611 (4.6 ‰)	108 607 (2.68 ‰)	6 707 (0.98 ‰)	840 (0.08 ‰)	23 933 (3 ‰)

Note: Treatment entry data for 2016, except for the Netherlands (2015) and Scotland (2016/17). Estimates of people who inject drugs are for 2015, except for Finland (2012) and the United Kingdom (2006).
Source: EMCDDA.

Syringe collection, preparation and analysis

In each of the six cities, a local research team was responsible for the sampling, collection and preparation of the syringes. The contents of the syringes were analysed by the team that collected them, with the exception of syringes collected in Amsterdam, which were analysed by the Lausanne research team. Depending on the availability of potential sampling locations and the local context, between 1 and 5 collection sites were selected in each city in order to maximise geographical coverage. The total of 18 sites across the 6 cities comprised 11 low-threshold facilities offering face-to-face needle and syringe exchange (NSP), 1 drug consumption room, and 6 street bins from automatic injection kit dispensers (AIKD) (see Figure 1). The social and demographic characteristics of the people who inject drugs served by each site broadly reflected the heterogeneity found between and within European cities (see Table 2).

FIGURE 1

Syringe collection sites, by city and type of service, ESCAPE, 2017

Face-to-face needle and syringe exchange programmes (NSP)

People who inject drugs can anonymously discard used syringes into an appropriate container in the low-threshold facility and receive in turn new injection paraphernalia.

Automatic injection kit dispensers with bins (AIKD)

Street-mounted automatic dispensers enable the self-operated exchange of injection equipment. Used syringes can be deposited in a special container in return for a token, which can be exchanged for an injection kit from the dispenser. AIKD has the potential to reach injecting drug users who are not in contact with health and social services.

Drug consumption rooms

In drug consumption rooms, the exchange process is reversed. A sterile syringe is given to a user. After the supervised injection, the user disposes the syringe in a container located in the supervised injection room.

TABLE 2

Socio-demographic characteristics of population living in the area of ESCAPE study sites, 2017

City	Estimated number of people currently injecting drugs	Number of sterile syringes distributed	Syringe collection sites	Number of syringes collected and analysed
Amsterdam **860 000 inhabitants (5 042/km²)**	Between 150 and 200		Three NSP services and one drug consumption room. The latter is located in the Red Light District and also provides sterile syringes. It is the only drop-in centre with a shelter for women. Clients of these services are aged between 22 and 71 years and are socially vulnerable. Self-reported substance use includes heroin, cocaine, methadone, amphetamine, cannabis and alcohol.	81
Budapest **2 000 000 inhabitants (3 314/km²)**	6 000	In 2017, an estimated 115 500 syringes were distributed in Budapest (35 000 by the NSP described below).	One face-to-face NSP. This low-threshold service is located in a poor neighbourhood, where there is a concentration of homeless people and sex workers. The area is also popular among tourists.	226
Glasgow **621 020 inhabitants (3 555/km²)**	5 500	350 436 needles and syringes were provided from all outlets in Glasgow city centre in 2017.	Two NSP services. One service is located at the edge of the city centre in a largely industrial area and includes a rehabilitation residential service. The other is located in the city centre in a mixed retail/ residential area, close to social services for the homeless.	195
Helsinki **643 272 inhabitants (3 002/km²)**	8 500	In 2017, three of the five NSP described below provided a total of 1 732 462 needles and syringes.	Five NSP. One site is located in the eastern part of downtown Helsinki, an area with social and health services for people who inject drugs, known for drug trade and drug users. A second site is located in the northern part of downtown Helsinki, in a housing unit with 100 residents with substance use and/or mental health problems. A third site is located close to the city centre, near a similar housing unit. The two remaining sites are located further east, one in a business and residential area with an open drug scene and trade, and the other in a residential area with a higher than average concentration of social housing.	284
Lausanne **144 597 inhabitants (3 395/km²)**	No data	157 238 syringes were distributed in 2017.	There is only one bin of AIKD in Lausanne. It is located in the central neighbourhood of Lausanne, served by two metro stations. During the day, people from diverse socio-economic background use this area. In the evening, it has significant nightlife activity and hosts marginalised groups.	233
Paris **2 140 526 inhabitants (20 000/km²)**	26 328 in the whole Paris region (Ile-de-France)	656 000 syringes were distributed in Paris in 2015.	Five bins of AIKD. Three sites are located next to train stations. In one of these sites users of AIKD include low-income and homeless people. The other two stations are busy public transport hubs frequented by people from diverse socio-economic backgrounds. The remaining two sites are located near metro stations in affluent neighbourhoods with well-integrated populations. One of the latter is famous for its nightlife.	259

Syringes were collected between August and November 2017. The research teams aimed at collecting 300 syringes per city, equally distributed across sites, which was considered a representative sample. The number of syringes collected per site depended on the number of sites selected in each city; the minimum required sample per site was set at 30 syringes. Where possible, syringes were collected from different containers to minimise the risk of collecting too many syringes from the same NSP user. When collecting used syringes from AIKD, the syringes in bins were shuffled before sampling. Syringes with damaged barrels were excluded and larger volume syringes (>1 ml) were only collected and tested in Glasgow and Helsinki. In Helsinki and Paris, needleless syringes were excluded, while in Amsterdam syringes with a crooked needle were excluded. In Glasgow, syringes used for image and performance enhancing drugs were excluded. In Helsinki, Lausanne and Paris, syringes were

visually assessed to identify broken needles and erased graduation marks, which were taken as a proxy for attrition and as a possible indication of reuse.

To reduce the risks associated with handling used injection material, a number of safety precautions were taken, such as wearing personal protective equipment (including safety goggles, gowns and anti-scratch gloves), having access to a bleach basin, and using sharps containers to recover the syringes.

Syringes were transported from the collection sites to the laboratory within 48 hours of being deposited, in order to limit degradation of the content. Once in the laboratory, syringes were stored at 4 °C (for analysis within 48 hours) or at –20 °C (for analysis beyond 48 hours). Syringe contents were extracted in methanol: the syringe was filled and emptied five times, and the contents were collected in a clean test tube (Figure 2). The recovered methanol solution was then filtered before analysis in order to eliminate solid particles, which could damage the analytical instruments.

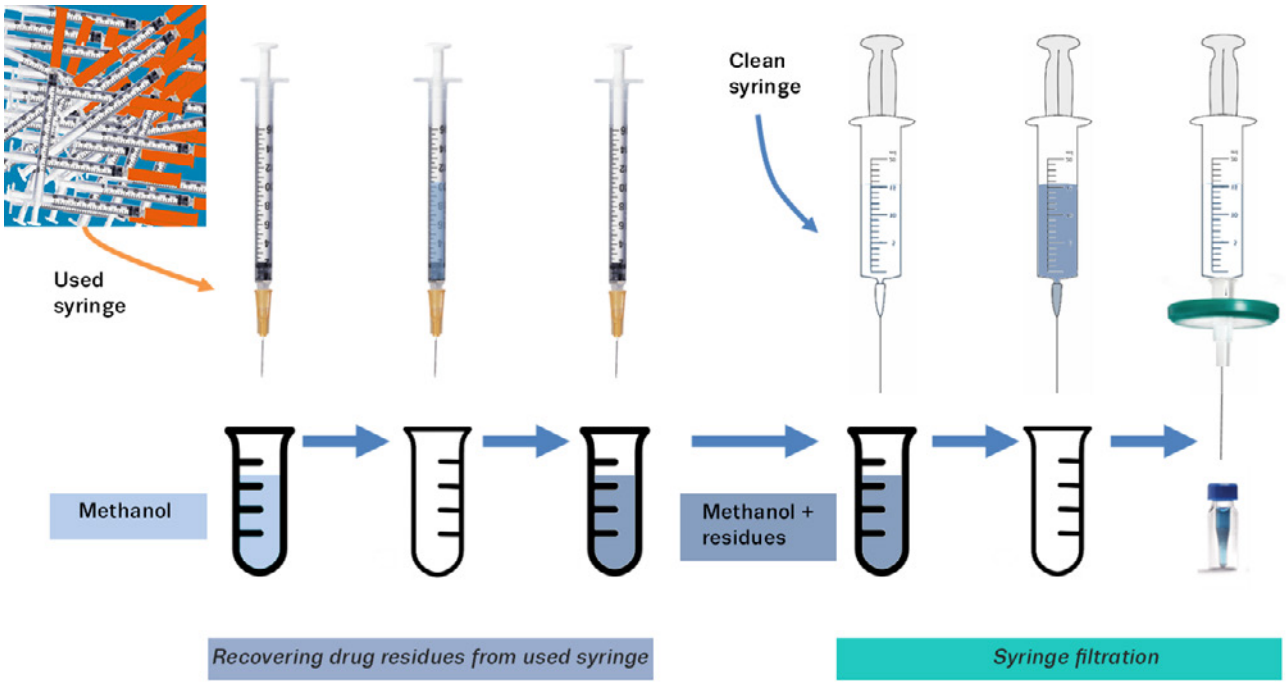
Target substances

Up to 115 drugs were tested for, depending on the analytical method used (see Appendix 1). In addition, syringes were screened for the presence of some metabolites, degradation products and adulterants (see the box 'Key terms'). Inactive diluents and binders were not considered in this study. The list of substances tested for is provided in Appendix 1, detailing which cities performed each test.

The analytical methods employed in this project have been previously used in similar studies: gas chromatography (GC), ultra-high or high performance liquid chromatography (UHPLC/ HPLC) coupled with mono or tandem mass spectrometry (MS or MS/MS) (Lefrançois et al., 2016; Maurer, 1992, 1999; Néfau et al., 2015; Péterfi et al., 2017). In Glasgow, Helsinki and Paris, chemists used a target-compounds method, allowing them to detect only the compounds marked in Appendix 1. Samples from Amsterdam, Budapest and Lausanne were analysed using a screening method that could potentially detect any compound, including all those listed in Appendix 1.

The results are presented by individual drug (cocaine, heroin, morphine, buprenorphine, methadone, ketamine) or by group of drugs (amphetamines, fentanyl and related substances, other opioids, synthetic cathinones, synthetic cannabinoids, benzodiazepines, phenidates, MDMA, other medications, other amphetamines and other drugs) (see Appendix 1). Only syringes that were positive for at least one substance (excluding metabolites and adulterants) were included in the analysis.

FIGURE 2
Extraction of syringe content for chemical analysis, ESCAPE, 2017



Key terms

Adulterant: A pharmacologically active compound that dealers mix with drugs to increase the volume of the product in order to maximise profits. For instance, levamisole — originally an anthelmintic medication, which has some antidepressant properties — is a common adulterant of cocaine. Pharmacologically inert diluents (such as sugar) were not screened for in this study.

By-product of production: Some drugs may be the result of the production process of another drug. For instance, codeine traces might be found in heroin.

Degradation product: A compound resulting from the natural breakdown of a drug over time. The degradation of a drug can occur in the syringe. For instance, heroin will naturally degrade into 6-MAM and morphine. In the analysis, any syringe testing positive for 6-MAM in the presence of either morphine or codeine was assumed to have once contained heroin and was classed as a 'heroin syringe'.

Drug: A psychoactive substance consumed with the aim of altering the user's mood and perception, through its effect on the central nervous system.

Drug group: In order to simplify the presentation of results for the large number of substances covered in this study, drugs were grouped according to their public health relevance and on the basis of their shared characteristics. The groups may thus combine chemical, pharmacological and use perspectives. For example, heroin and methadone are reported separately from 'other opioids' and 'other medications', respectively.

Metabolite: Metabolites are residues of a drug after it is broken down in the body. They can be found in the blood, urine or faeces of users after consumption of the drug regardless of the route of administration. Blood containing metabolites can enter a syringe during injection. In this study, tests were carried out for metabolites of heroin (6-monoacetylmorphine, 6-MAM), cocaine (benzoylecgonine) and benzodiazepines (7-aminoclonazepam). Some metabolites, for instance 6-MAM, can also result from degradation. Syringes testing positive only for metabolites were excluded from the analysis.

Detected drugs

Regional and local variations

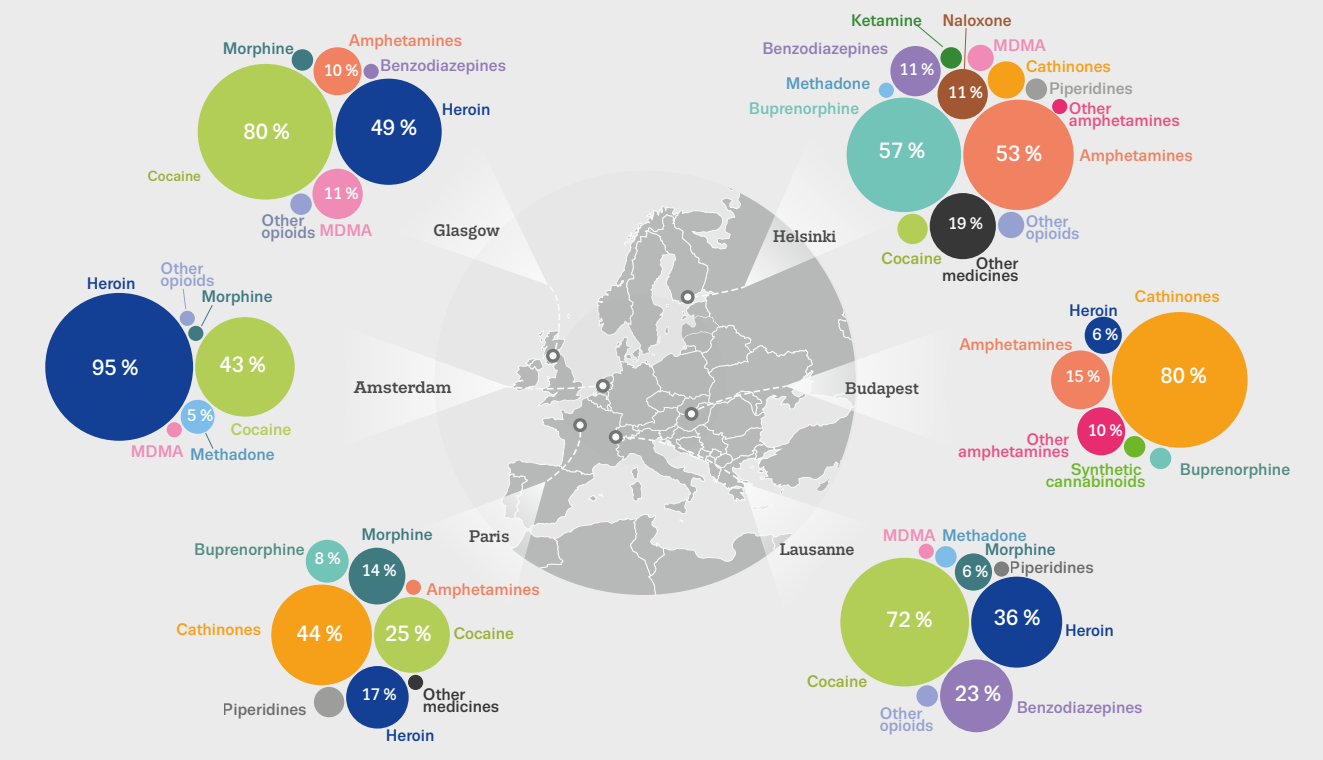
The research teams collected a total of 1 676 syringes in the six cities. The results of the qualitative chemical analysis were obtained for 1 521 of the 1 676 syringes (91 % of collected syringes). Analysis was not performed on blocked syringes that could not be rinsed. At least one drug was found in 1 278 syringes (84 %); 243 syringes (16 %) did not test positive for any drug; of these, 210 did not test positive for any screened substance and 33 tested positive for only metabolites or adulterants. There are four possible explanations for none of the tested substances being detected in a syringe: the syringe was not used; it was used and then thoroughly washed; it was used and the substance(s) degraded to undetectable levels; it was used to inject other substances, such as pharmacologically inactive compounds or drugs not included in the screening protocol.

Overall, the drugs most often found in the syringes were cocaine, heroin, cathinones, buprenorphine and amphetamines, with considerable differences across cities (see Figure 3). Traces of 46 different drugs were identified in the syringes analysed in the study. Heroin was the most commonly detected drug in Amsterdam, and it was found in almost half of the syringes in Glasgow and over one-third of those in Lausanne — two cities where cocaine dominated. In Helsinki, more than half of the samples tested positive for buprenorphine or amphetamines. Synthetic cathinones were found in 8 out of 10 of samples from Budapest and in 4 out of 10 from Paris. Benzodiazepines were often found in syringes from Lausanne and Helsinki. Substances grouped as 'other medications' were detected in every fifth syringe in Helsinki.

Although the number of syringes collected does not directly reflect the number of individuals providing them, some of the regional specificities observed are in line with self-reported data from drug treatment centres and surveys. In Finland, among those entering drug treatment in 2016 who reported injecting, the most commonly reported primary drugs were buprenorphine (66 %) and amphetamines (30 %). In the Netherlands, where the number of people who inject drugs is relatively small, 80 % of injectors entering drug treatment in 2015 reported heroin as their primary drug. In Hungary, while heroin is the drug injected by the majority of treatment entrants who report this mode of administration, self-reported data from NSP services have shown the growing importance of synthetic cathinones among injectors (reported by 80 % of

FIGURE 3

Percentage of syringes by detected drug group, by city, ESCAPE 2017



NB: Circle area is proportional to percentage of syringes in each location in which the substance was detected. More than one substance may be detected in a single syringe, therefore city totals may exceed 100 %.
Number of syringes analysed: Amsterdam, 81; Budapest, 233; Glasgow, 195; Helsinki, 284; Lausanne, 233; Paris, 259.

NSP clients in 2015), which was also confirmed by a similar analysis of syringe residues (Péterfi et al., 2017). In Glasgow, unpublished 2018 data from NSP services showed that heroin and cocaine were injected by most clients, with 82 % injecting heroin, 77 % cocaine and 26 % a combination of heroin and cocaine in the last 6 months. In the current study, after accounting for heroin metabolites, 49 % of the syringes from Glasgow tested positive for heroin and 80 % for cocaine.

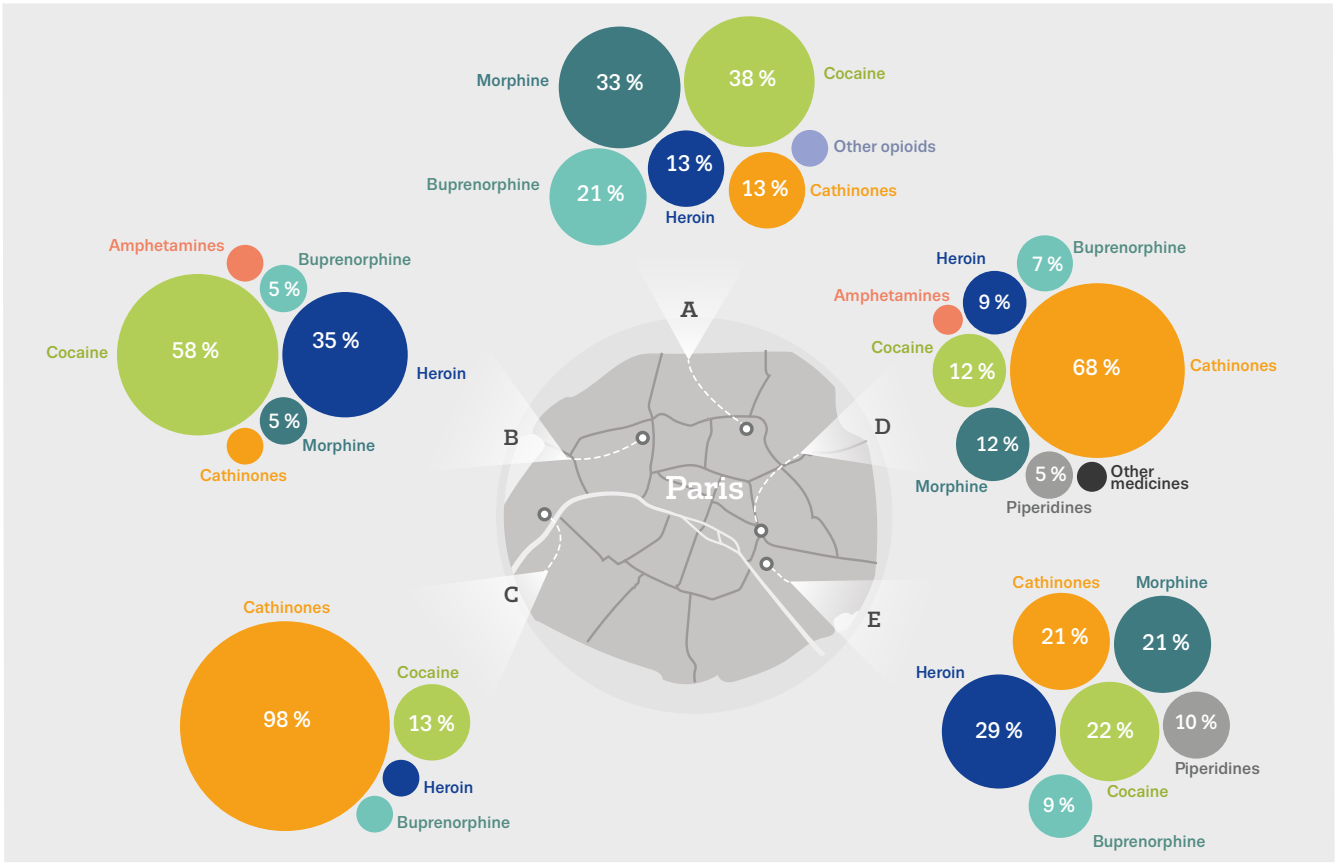
This pattern, however, is not reflected in the Scottish drug treatment data, where heroin is named as the primary problem drug by 95 % of treatment entrants, compared with only 3 % for cocaine (see Table 1). Similarly, syringe residues from Paris do not reflect the latest 2017 national treatment data from France (see Table 1), where heroin was reported by the majority of injectors. In the ESCAPE study, heroin came third, after cathinones and cocaine. The discrepancy may be partially explained by the different coverage of the data sources: syringe residues reflect the local situation, whereas the treatment data are national. Moreover, in Paris, syringes were collected only from street bins and not from drug services, where surveys are conducted. ESCAPE provides analytically confirmed results (in contrast to self-reports in treatment data and surveys). Importantly, it is likely to reach populations that are not in contact with any health services and gives a snapshot of currently injected substances, which may not be reflected in treatment demands until some time in the future.

Results from Paris, and to some extent Helsinki, also suggest in-city variation in drugs injected, which likely reflects the different socio-demographic profiles of people who use drugs across the sites. In Paris (Figure 4), cocaine and opioids were most commonly found in syringes collected near train stations in the north of the capital — areas frequented by marginalised and impoverished users. Synthetic cathinones, on the other hand, were the dominant group detected in syringes from the west and the east of the city — neighbourhoods frequented by more affluent and socially integrated users.

In a previous study conducted in 2014, cocaine was the only substance detected in syringes collected from the western site (C) (Néfau et al., 2015). In 2017, synthetic cathinones were found in 98 % of the syringes collected from the same site, indicating a new local trend and demonstrating the capacity of this method to quickly detect such changes and inform services that may address them.

FIGURE 4

Percentage of syringes by detected drug group, by site, Paris, ESCAPE 2017



NB: Circle area is proportional to percentage of syringes in each location in which the substance was detected. More than one substance may be detected in a single syringe, therefore location totals may exceed 100 %.
Number of syringes analysed at each location: A, 39; B, 40; C, 40; D, 82; E, 58.

In Helsinki (Figure 5), the most striking difference is between sites located in the downtown area and those in the eastern part of the city. In the more socio-economically diverse downtown neighbourhoods, amphetamines were detected in most syringes. In the eastern areas, where poorer segments of the population are concentrated, buprenorphine was detected in the majority of syringes, while more diverse, western parts of the city registered more syringes with amphetamines.

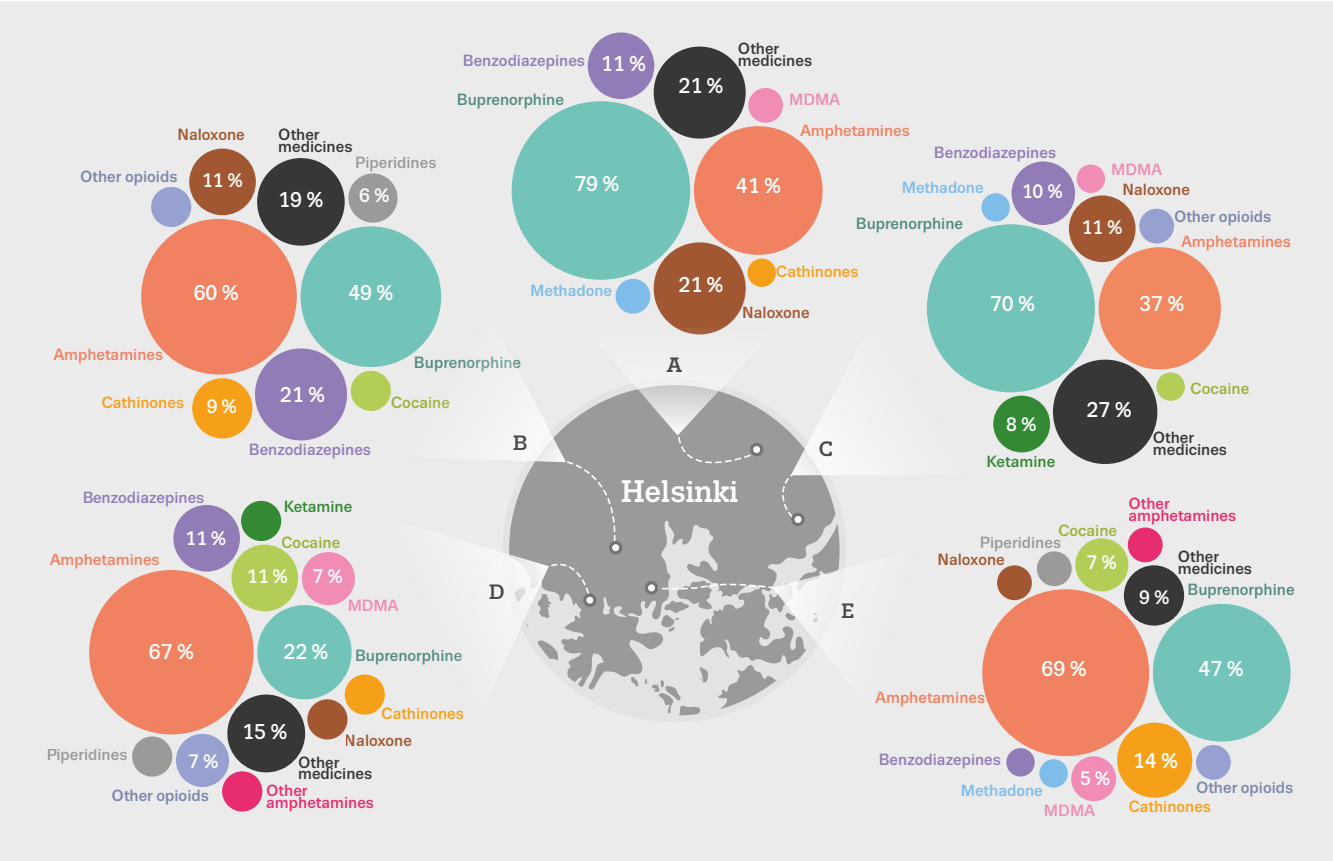
Stimulant injection found in all cities

While opioids, which have traditionally been associated with injecting, were commonly found in syringes, the high proportion of syringes testing positive for stimulants, such as cocaine (Amsterdam, Glasgow, Lausanne), synthetic cathinones (Budapest, Paris) and amphetamines (Helsinki, Budapest), suggests that injecting stimulants is a widespread practice among people who inject drugs in these European cities. The high prevalence of stimulants in syringes could be associated with the higher injecting frequency typical of stimulant use (Platt et al., 2015). It could also be the result of traces of blood containing stimulants drawn into the syringe during injection but consumed prior to injection, possibly through other modes of administration. However, other data also point to high levels of stimulant injection among people who inject drugs. A high prevalence of synthetic cathinones injection among clients of low-threshold programmes in Hungary was reported in 2014 (>50 %) (Kapitány-Fövény and Rácz, 2018). Similarly, among treatment entrants in Finland reporting injecting as a main route of administration, injection of amphetamine reached 28 % in 2016. In Glasgow, the 2015 HIV outbreak among people who inject drugs has been strongly linked, among other factors, to injecting cocaine (McAuley et al., forthcoming).

In a trendspotter study conducted in 2018 by the EMCDDA, an increase in cocaine powder injecting, alone or in combination with heroin, was reported in drug consumption rooms in France, Germany, Luxembourg, Spain and Switzerland. The study also highlighted an increasing trend in injecting cocaine base (crack), either

FIGURE 5

Percentage of syringes by detected drug group, by site, Helsinki, ESCAPE, 2017



NB: Circle area is proportional to percentage of syringes in each location in which the substance was detected. More than one substance may be detected in a single syringe, therefore location totals may exceed 100 %.
Number of syringes analysed at each location: A, 66; B, 70; C, 63; D, 27; E, 58.

alone or as a cheaper alternative to traditional heroin-cocaine preparations. The data analysed here do not distinguish whether cocaine residues found in syringes were from cocaine hydrochloride or cocaine base. Field reports from Paris indicate that marginalised and homeless users inject crack cocaine, (EMCDDA, 2018b). In Scotland, the NESI study among NSP clients (Health Protection Scotland, 2017) suggests that powder cocaine is the form that is being injected.

Synthetic cathinones were found in a majority of syringes from Budapest. This class of substances first appeared on the local drug market after the heroin shortage in 2011, and cathinones have since presented a substantial challenge for harm reduction services. The shift towards cathinones was linked to increased frequency of injecting, reuse and sharing of syringes, and higher HCV prevalence among stimulant users. The main cathinones injected were pentedrone and MDPV (Tarján et al., 2015). Analysis of syringe residues has shown substantial temporal changes in the occurrence of different cathinones (Péterfi et al., 2017). The current study did not identify any syringes with either pentedrone or MDPV. The most commonly found cathinones were N-ethylhexedrone (76 %) and 4-Cl-alpha-PVP (45 %). In Paris, by contrast, 3-MMC or 4-MMC (mephedrone) (34 %) and 4-MEC (24 %) were the only cathinones detected. The analytical method used by the French team does not distinguish 3-MMC from mephedrone. It is likely, however, that 3-MMC is more commonly injected, as 4-MMC (mephedrone) has been listed as a controlled substance since 2010 and 3-MMC was the most frequently seized new psychoactive substance in 2017 (Néfau, 2018). In Helsinki, six different cathinones were detected in syringes, but less frequently; the most common cathinone was alpha-PVP (4 %).

MDMA was detected in Amsterdam (1 syringe), Lausanne (3), Helsinki (8) and Glasgow (22). In Glasgow, syringes containing traces of MDMA represent 11 % of the sample, and most of these also tested positive for amphetamines. These figures contrast with treatment data, in which MDMA injecting is rarely reported at the national level with the exception of Hungary, where 13 out of 126 treatment entrants reporting injecting as a route of

administration mentioned MDMA as their primary drug. MDMA may have been introduced into syringes through the blood of users, or as an adulterant. Selection bias also cannot be ruled out in the case of Glasgow, where tested syringes might have come from a small number of users.

Injecting opioid substitution medications

Evidence shows that opioid substitution treatment improves mental health and reduces illicit opioid use, risk behaviour and mortality (EMCDDA, 2017; WHO, 2009). The main opioid substitution medications prescribed in Europe are methadone (63 % of substitution treatment clients) and buprenorphine (35 %); slow-release oral morphine and diacetylmorphine (medical grade heroin) are used to a much lesser extent (3 %) (EMCDDA, 2018a). Diversion and misuse of opioid substitution medications have been reported (EMCDDA and Europol, 2016), but there is currently no systematic monitoring in place, and empirical data on the extent of their misuse are lacking. The presence of these substances in syringes may be an indication of such misuse.

This study detected buprenorphine in most of the syringes tested in Helsinki (57 %), where it was the most frequently detected substance. Buprenorphine was also found in syringes from Paris (9 %) and Budapest (2 %). These findings are broadly in line with national data on drug treatment: 80 % of opioid users entering treatment in Finland in 2016 reported use of buprenorphine, while it was reported by 10 % of treatment entrants in France and by none in Hungary and the Netherlands.

In Helsinki, about one-fifth of the syringes testing positive for buprenorphine also contained traces of naloxone. This finding points to the misuse or diversion of Suboxone — a formulation that combines buprenorphine with the opioid antagonist naloxone, in order to discourage injection. In Finland, Suboxone is prescribed to 62 % of opioid substitution clients; only 2 % of opioid substitution clients are prescribed buprenorphine alone. The disproportionately low occurrence of the buprenorphine-naloxone combination in syringes, however, suggests that most of the buprenorphine that is injected in Helsinki is not diverted from locally prescribed medication. Rather, evidence from seizures suggests that it is increasingly smuggled from France via Sweden (EMCDDA and Europol, 2016). The presence of naloxone in some syringes supports previous concerns that Suboxone may be misused and injected, and that naloxone does not entirely attenuate the effect of buprenorphine (Alho et al., 2007; Strain et al., 2000). In France, 61 % of opioid substitution clients are prescribed buprenorphine. Among those, 7 % are prescribed Suboxone. Naloxone was not detected in buprenorphine syringes from Paris.

Methadone was only detected in 13 syringes: 4 in both Amsterdam and Helsinki, and 5 in Lausanne. However, it is prescribed to more than three-quarters of opioid substitution clients in Hungary, the Netherlands, Scotland and Switzerland. Injection of methadone syrup is difficult but has been documented; it requires dilution in water and often also the use of larger volume syringes (sometimes larger than 20 ml), which were not sampled in this study. This, together with the fact that more than half of the methadone clients in France receive the medication in the form of capsules designed to prevent injection (Roux et al., 2011), could explain why methadone was not detected in any syringes collected in Paris, although the substance was mentioned in 31 to 45 % of drug-related deaths reported in France each year from 2010 to 2015 (Observatoire Français des Drogues et des Toxicomanies, 2018).

Morphine is sporadically prescribed as an opioid substitution medication in Switzerland (Besson et al., 2014). It was detected in almost half of the syringes in Glasgow and Amsterdam, one-third of the syringes in Paris, and one-quarter of the syringes in Lausanne (Appendix 2). The presence of morphine in syringes is likely the result of heroin degradation, rather than intentional injection of the drug. Indeed, morphine was typically found in syringes that also contained traces of heroin or its metabolite 6-MAM. If the co-occurrence of morphine and 6-MAM is considered as indicating heroin alone (as presented in Figures 3-5), the share of syringes with clear signs of having originally contained morphine decreases to 1-6 % of syringes in Amsterdam, Glasgow and Lausanne. Paris, where 40 % of morphine-positive syringes did not test positive for any other compound (including heroin metabolites), seems to be the exception to the rule. This finding is consistent with data from the drug consumption room in Paris and other field reports, which show diversion and injection of morphine sulphate (an opioid analgesic) (Cadet-Taïrou and Gandilhon, 2014). The same field reports also suggest that larger syringes (2 ml) are the preferred choice for morphine sulphate injections. Therefore by collecting only 1 ml syringes, the sampling strategy may have led to this practice being undercounted in Amsterdam, Budapest, Lausanne and Paris.

Benzodiazepines injected with opioids or stimulants

Misuse of benzodiazepines among high-risk drug users is a recognised and widespread phenomenon. Evidence suggests that co-consumption of benzodiazepines

increases the risk of overdose among high-risk opioid users. Furthermore, injecting crushed and dissolved medications that are intended for oral administration puts users at higher risk of vascular complications and infections (Roux et al., 2011).

Benzodiazepines tested for in this study differed by city (see Appendix 1). Common benzodiazepines such as alprazolam, clonazepam, diazepam and midazolam were tested in all cities. Some new benzodiazepines, which may appear on the drug market from various illegal sources, were tested for in Amsterdam, Budapest, Glasgow, Helsinki and Lausanne.

The practice of injecting benzodiazepines seems to be limited to Helsinki (where 11 % of all syringes were positive for this group) and Lausanne (23 %). In Glasgow, one syringe was found to contain traces of diazepam, while benzodiazepines were not detected in any syringes from Amsterdam, Budapest or Paris. In Lausanne, midazolam accounted for almost all benzodiazepine-positive syringes, but it accounted for half of the benzodiazepine detections in Helsinki, where alprazolam, clonazepam, diazepam, oxazepam and temazepam were also detected. Injection of midazolam has been noted, in unpublished reports, by local social services in Lausanne, where alcohol tabs are provided to reduce risks associated with the injection of crushed and dissolved coated tablets.

Benzodiazepines may be used to self-medicate adverse effects of illicit drugs or medicate unrelated conditions. They may also be used recreationally, for their own effect or to moderate the effect of another drug (Jones et al., 2012). In this study, most syringes testing positive for benzodiazepines also contained traces of at least one other substance. The literature links misuse of benzodiazepines predominantly to opioid users. This was the case in Lausanne, where benzodiazepines were most often found in syringes also testing positive for heroin. In Helsinki, just under one-third of the syringes containing traces of benzodiazepines also tested positive for buprenorphine. Reports have suggested that some opioid substitution clients use benzodiazepines to increase or prolong the effect of the substitution medication when under-dosed (Lofwall and Walsh, 2014). Irrespective of the possible motivations for combining benzodiazepines and buprenorphine, this practice increases the risk of respiratory depression and overdose, counteracting the ceiling effect of buprenorphine (Reynaud et al., 2002).

The analysis of syringe residues from Helsinki shows that benzodiazepines can also be associated with stimulant drugs. In the Finnish capital, half of the syringes containing traces of benzodiazepines tested positive for methamphetamine. Stimulant injectors may use benzodiazepines to 'come down', or to treat withdrawal and anxiety.

Two important aspects should be considered when interpreting these results. First, injecting may not be the preferred route of administration of benzodiazepines. The majority of those entering treatment for problems related to use of benzodiazepines in Europe report oral consumption; less than 1 % report injecting them. Second, it is possible that regardless of the original mode of administration, benzodiazepines found in a syringe may originate from blood introduced into the syringe during injection, potentially leading to an overestimation of their injection.

While people who inject benzodiazepines are only a small fraction of all benzodiazepine users, the overall burden of their misuse is high. This is supported by data from Scotland where, while only one syringe tested positive for benzodiazepines in Glasgow, more than half of the overdose deaths recorded in 2017 in Scotland were linked to benzodiazepines (National Records of Scotland, 2018).

Other medications than benzodiazepines were overall less often detected, although in Helsinki they were identified in almost every fifth syringe (19 %). Pregabalin (9 %) and gabapentin (5 %) were the ones most often detected. Both medications are reported to have sedative, euphoric and psychedelic effects, and a potential to develop dependence (Schifano et al., 2011).

Absence of high-risk fentanyl

Fentanyl and related substances are highly potent synthetic opioids that have been linked to several fatal drug poisonings and are increasingly present on the European illicit drug market (EMCDDA, 2018a). These substances can be sold as heroin or mixed with heroin or cocaine, putting users at risk of overdose.

Deaths associated with fentanyl and fentanyl derivatives (i.e. substances that share a chemical scaffold with pharmaceutical fentanyl) have been reported in the United Kingdom, Finland, France and Hungary. Seizure data showing the presence of fentanyl derivatives on the drug market are available from Finland, France, the United Kingdom and, to a lesser extent, Hungary and the Netherlands. Nonetheless, neither fentanyl nor any fentanyl derivatives tested for in this study were found in the syringes. For instance, between 2012 and 2017, the French addictovigilance network reported 8 acute intoxications with fentanyl and 8 acute intoxications with

fentanyl derivatives (5 with ocfentanyl, including two deaths; 2 with carfentanil, and 1 with butyrylfentanyl) (Centre d'Evaluation et d'Information sur la Pharmacodépendance, 2017), yet there were no detections of these substances or other fentanyl derivatives in the syringes analysed in Paris. The absence of fentanyl and fentanyl derivatives in syringes may indicate that these substances are not commonly injected in the participating cities or that services where syringes were collected may not be frequented by their users. The results might also underestimate the injection of these substances, due to the degradation of the low concentrations usually involved, making them harder to detect. Additionally, four of the top five seized fentanyl derivatives in Europe (valerylfentanyl, 4-fluoro-isobutyryl-fenatnyl, acryloyfentanyl and cyclopentylfentanyl) (EMCDDA, 2018a) were not included in the screening protocol for Paris.

In Helsinki, a low-dose synthetic opioid U-47,770 was detected in one syringe. The drug was linked to several deaths in Finland in the past two years (Kriikku, 2017).

Polydrug use

Polydrug use refers to the consumption of more than one drug by an individual over a certain period of time. It is associated with increased psychopathology, more risk behaviours, lower treatment adherence and worse health outcomes (Connor et al., 2014). Polydrug use is common among high-risk drug users. It includes simultaneous use (or co-use) of different drugs, such as the simultaneous injection of heroin and cocaine known as 'speedballing' (or 'snowballing' in Scotland). This pattern of use is difficult to assess with standard monitoring tools. The presence of multiple drugs in a syringe can be an indication of co-use and may help to identify commonly used combinations.

Overall, 54 % of the syringes tested contained traces of two or more drugs: 32 % of the syringes contained traces of two drugs, 18 % three, and 4 % four to seven drugs. Morphine and codeine were often detected in syringes testing positive for heroin, likely as by-products of synthesis, metabolites, or the results of heroin degradation. If 6-MAM in the presence of morphine or codeine is considered as an indicator of heroin, rather than a mixture of drugs (Appendix 2), the overall proportion of syringes with clear evidence of having contained multiple drugs drops to 50 %. On this basis, the percentage of syringes testing positive for two or more substances ranged from 34 % in Lausanne to 62 % in Helsinki and 64 % in Budapest.

The most common combination found was heroin and cocaine, detected in 148 syringes (12 %). Additional drugs (other than morphine or codeine) were found in 15 % of the heroin-cocaine syringes (Figure 6). Heroin and cocaine was the most common combination in three cities: Amsterdam (42 % of syringes), Glasgow (36 %) and Lausanne (17 %). In Lausanne, more than one-third of the heroin-cocaine syringes also tested positive for benzodiazepines. The heroin-cocaine combination was rarely detected in syringes from Paris (2 %) and was not found at all in Budapest and Helsinki — two cities where heroin was detected in very few syringes. Those entering drug treatment who report heroin as a primary drug (regardless of the mode of administration) frequently report use of both heroin and cocaine. Co-injection of the two drugs is, however, less common than concurrent use.

In Helsinki, where the main injected opioid is buprenorphine and the main injected stimulants are amphetamines, 17 % of the syringes contained traces of both (and 76 % of these tested positive for at least one other drug). Other combinations of a stimulant and an opioid found in syringes included buprenorphine and cocaine in Paris, heroin and cathinones in Budapest and Paris, buprenorphine and cathinones in Budapest and Helsinki, and cocaine and methadone in Lausanne. These combinations may be an alternative to the heroin-cocaine mixture, when one or both is unavailable.

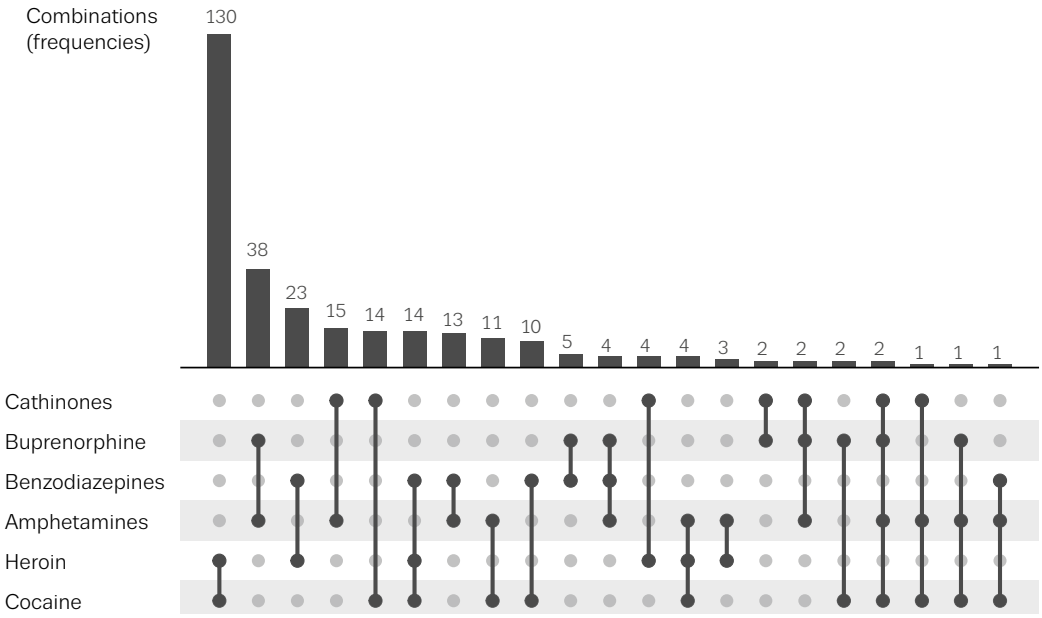
As mentioned above, benzodiazepines were often found in syringes in combination with other substances. In Lausanne and Helsinki, most of the syringes testing positive for benzodiazepines also contained traces of an opioid or a stimulant.

The majority (80 %) of syringes testing positive for a synthetic cathinone contained traces of at least one other drug. In more than two-thirds of these (69 %), another cathinone was detected. Cathinones were also found in combination with other substances, albeit less frequently. In Helsinki, they were detected with amphetamines and opioids. In Paris, cathinones were found in the presence of cocaine, while other new psychoactive substances (such as new amphetamines or synthetic cannabinoids) were found in the company of cathinones in syringes from Budapest.

Combinations of two or more stimulants (cocaine, amphetamine, methamphetamine or synthetic cathinone) were not uncommon and overall appeared in 10 % of syringes (4 % in Budapest, 5 % in Paris, and 6 % in Glasgow). In Helsinki, 32 % of syringes contained the residues of a mixture of stimulants, mostly of amphetamine and methamphetamine.

FIGURE 6

Most frequent combinations of drugs found in syringes ESCAPE, 2017



NB: Results for syringes containing traces of two or more drugs from the six most common drugs/group of drugs.

It is important to note that the detection of multiple substances in a syringe does not necessarily imply intentional injected polydrug use. First, drugs may enter a syringe in blood drawn by the user during injection, and the methods used in this study are sufficiently sensitive to detect traces of drugs introduced in this manner. If, for example, a person has smoked cocaine prior to injecting heroin, and drawn blood into the syringe, it may test positive for the two drugs. Second, the detection of multiple substances in a syringe can be the result of adulteration not known to the user. Cheap stimulants such as amphetamines or cathinones are used by dealers to adulterate more expensive drugs (Giné et al., 2014). Third, some drugs are degradation products of other drugs. Examples of this are morphine from heroin and amphetamine from methamphetamine. Fourth, the detection of several substances in one syringe may be the consequence of reuse of the syringe by one or more users.

Reuse and sharing of syringes

Users are exposed to increased health risks when they reuse injection equipment (damaged and non-sterile equipment causes wounds and skin infections) or share it with multiple users (transmission of blood-borne infections). Within the scope of this study, it was not possible to distinguish a syringe testing positive for multiple substances that has been used once (simultaneous or co-use), from a syringe that has been reused by one user (polydrug use), from a syringe that has been used by several users (sharing of syringes).

Research teams from Helsinki, Lausanne and Paris looked for erased graduation marks on syringes as a sign of attrition and as a proxy measure of reuse. In Lausanne, 8 % of collected syringes showed visible signs of attrition. The corresponding share for Helsinki and Paris was 3 %. This figure is lower than that presented in a 2015 survey among injectors in low-threshold services in France, where 15 % reported having injected with syringes that had been used by others or having passed their used syringes to others in the previous month (Cadet-Taïrou et al., 2018). Looking at visible signs of attrition as an indication of reuse has significant limitations. Erased graduations could be due to intended marking by the user to distinguish used syringes (therefore not necessarily implying reuse, quite the contrary). On the other hand, sharing of syringes among injectors can happen without causing any visible damage to the syringe. In both cases, the proxy of reuse might not reflect the true level of sharing among injectors, and surveys where users are asked about their sharing practices remain better measurement tools.

Comparing national-level data from NSPs and national estimates of the number of people injecting drugs provides a measure of the coverage of sterile syringe provision. In Finland, an estimated 370 sterile syringes were provided per person injecting drugs in 2017 (EMCDDA, 2018a); in France, the coverage was estimated at 113 sterile syringes per person injecting drugs per year in 2017. The WHO

target for the elimination of hepatitis B and C is 300 sterile syringes per user per year by 2030 (WHO, 2017).

Adulteration

Adulterants are pharmacologically active substances, which may be toxic, have adverse consequences, and — similarly to polydrug use — may increase health risks for users. For instance, levamisole, a common adulterant of cocaine, has been linked to convulsions, insomnia, damage of white matter in the brain, weakened immune system and acute coronary syndrome (Brunt et al., 2017). Phenacetin, another cocaine adulterant, has neurotoxic and carcinogenic adverse effects (Solimini et al., 2017). Eight common adulterants were tested for in this study: dextromethorphan and levamisole in all cities; griseofulvine, paracetamol, caffeine, lidocaine and phenacetin in Amsterdam, Budapest and Lausanne; hydroxyzine in Amsterdam, Budapest, Helsinki and Lausanne. Inert diluents and binders were not included in the screening protocol. The analysis of adulterants was limited to syringes that tested positive for only one main drug.

Among the 237 syringes in which cocaine was the only drug detected, levamisole was present in 38 %, phenacetin in 29 %, caffeine in 19 % and lidocaine in 10 %. Hydroxyzine was detected in one syringe (0.4 %) and paracetamol in two (0.8 %) with cocaine. Cocaine is often described as the most adulterated drug (Kudlacek et al., 2017), yet no adulterant was detected in half (53 %) of the syringes testing positive for cocaine. This finding might be related to recent changes in cocaine purity suggested by other sources (EMCDDA, 2018b).

Among the 134 syringes in which heroin was the only drug detected (besides morphine and/or codeine), caffeine was found in 50 %, paracetamol in 30 % and griseofulvine in 9 %. Six heroin syringes (5 %) tested positive for phenacetin. Almost half of the heroin syringes (49 %) did not test positive for any of the screened adulterants; 19 % tested positive for one adulterant and 32 % for two or more.

Caffeine was the only adulterant detected in the presence of amphetamines. It was found in 14 out of 22 syringes (4 %) that tested positive for no drug other than amphetamine. It should be considered, however, that the presence of cathinones alongside amphetamine in syringes in Helsinki (8 % of all amphetamine syringes) may have been the result of adulteration rather than intentional polydrug use (Giné et al., 2014). Hydroxyzine was found in one of the 17 (6 %) syringes testing positive for methamphetamine and no other drug. While no adulterants were found in buprenorphine syringes, adulterants were detected in some syringes testing positive for methadone (caffeine, phenacetin and paracetamol). Phenacetin was also detected in one syringe testing positive for MDMA.

Limitations

The first phase of this project was designed as a pilot study for the application of this innovative method, involving researchers in six sentinel European cities. The following caveats apply to the results presented here.

The number of syringes collected and tested cannot be translated into a number of individual users. A small number of users could contribute a disproportionately large number of syringes; for example, if some users brought back their syringes in bulk. In addition, some syringes may have been used by several people. The method therefore does not measure prevalence of injecting nor does it necessarily provide the relative prevalence of the different substances used among injectors. For example, a high number of syringes testing positive for stimulants could reflect the higher frequency of injecting among stimulant users, rather than a high prevalence of stimulant use among people who inject drugs.

While all laboratories screened for the most common drugs, the final list of screened substances varied between sites, depending on the laboratory methods used. In one city (Helsinki), syringes testing negative for a first list of substances were tested a second time for another set of substances. Some drugs (e.g. methadone syrup) are known to be injected in syringes larger than 1 ml. Only Glasgow and Helsinki collected syringes larger than 1 ml. The study might therefore have underestimated the presence of these drugs in cities where only 1 ml syringes were collected.

Drugs in syringes may degrade over time and might become undetectable. In the case of heroin, metabolites and degradation products indicate the presence of the drug in the syringes even after the heroin has degraded. This does not apply for other substances. The time lag between injection and collection was unknown for syringes from street bins and low-threshold services. In drug consumption rooms, however, syringes were collected immediately after injection.

The detection of a drug in a syringe indicates that the syringe was used to inject the drug. There is, however, an alternative explanation. The drug may come from traces of blood originally drawn into the syringe during an injection. In such a case, the user would have consumed the drug prior to the injection, possibly through other modes of administration (e.g. smoking, snorting). If a metabolite is found, it is likely to have been detected from blood traces. Some metabolites, however, are not distinguishable from degradation products (e.g. 6-MAM). This study did not test for the presence of blood in syringes. It is therefore difficult to identify the source of the metabolite. For the analysis, any syringe testing positive for 6-MAM along with either morphine or codeine was assumed to have once contained heroin and was classed as a heroin syringe. Syringes in which only metabolites were detected were excluded from the analysis.

When a drug is found in a syringe, it is an indication that it has been injected intentionally by the user. However, dealers can mix the drug with pharmacologically active substances to increase the volume of the product (adulteration). In this case, the user might be injecting substances unintentionally. This study did not collect information directly from users. Thus it is not possible to distinguish intentional from unintentional use.

Within the scope of this study, it was not possible to distinguish a syringe with multiple drugs that has been used once (simultaneous or co-use), from a syringe that has been reused by one user (polydrug use), from a syringe that has been used by several users (sharing of syringes).

Key issues

Within a global market for drugs, strong regional and local variations persist. It is important that public health responses to injecting drug use be tailored to local needs, defined by local data. The regional differences in the drugs injected reflect different geographical markets, with their own trafficking networks (EMCDDA and Europol, 2016) and users' preferences. The results of this first European syringe collection campaign outlined some key patterns that have public health implications.

While heroin has traditionally been associated with injecting, in all six cities a high proportion of the syringes was found to contain traces of stimulants, which may indicate a high prevalence of stimulant use among people who inject drugs. The potentially high level of stimulant injection suggested by the results of the current study has public health implications. First, long-term stimulant use may cause serious cardiovascular diseases and result in psychiatric comorbidities. Second, the injection of cocaine, amphetamine or synthetic cathinones is associated with more frequent injections and unsafe sex (Cavazos-Rehg et al., 2009). HIV outbreaks among people who inject drugs in cities that have well-functioning harm reduction services (Giese et al., 2015; McAuley et al., forthcoming) are a strong signal that stimulant injection constitutes a particular challenge for public health. It requires scaling up harm reduction services in order to reduce the risk of blood-borne and sexually transmitted diseases.

Opioid substitution medications, most notably buprenorphine, can be misused and injected. The current study documents this practice in Helsinki and, to a lesser extent, in Paris. When taken according to medical prescription and combined with psycho-social support (WHO, 2009), opioid substitution treatment reduces illicit opioid use, risk behaviours and mortality and improves the mental health of patients. The misuse of opioid substitution tablets through injection, however, has been associated with fatal and non-fatal overdoses, and vascular and cutaneous complications (Bouquié et al., 2014). Strategies to reduce diversion and injection of opioid substitution medications include prescription of formulations that are harder to inject (methadone, which is commonly prescribed in syrup or capsule formulation, and Suboxone, which contains naloxone). However, naloxone was detected in syringe residues, indicating injection of Suboxone. Other strategies to reduce misuse of opioid substitution medications include supervised dosing and the monitoring of prescriptions by health authorities (EMCDDA, 2017).

Half of the syringes tested contained traces of two or more drugs. Despite some limitations (it is not possible to differentiate simultaneous from sequential use and sharing of syringes), these results confirm that injecting polydrug use may be common among some groups of people who inject drugs. Polydrug use increases the risk of drug-related harms: the co-injection of cocaine and heroin amplifies the negative cardiovascular effects of cocaine, while cocaine can mask the sedative effects of opioids, increasing the risk of delayed overdose (EMCDDA, 2017). Co-use of cocaine is associated with poorer compliance with opioid substitution treatment (Rowan-Szal et al., 2000). The combination of opioids and benzodiazepines increases the risk of overdose. Harm reduction and drug treatment services need to provide information on the health risks associated with these specific combinations of substances.

Conclusion

The ESCAPE approach provides local information that can be used for local interventions. It complements existing monitoring tools (such as surveillance data from drug treatment centres) but does not replace them. Well-designed observational studies, collecting behavioural data and qualitative information from interviews with drug users in low-threshold services or using respondent driven sampling, are still the best tools to obtain information on many aspects of injecting, including reuse and sharing. Nevertheless, the timely, laboratory-confirmed local data on injected substances and patterns of injection provided by the ESCAPE approach can help to guide local responses. Importantly, by collecting injecting material from street bins, it potentially provides information on groups of people who inject drugs that are not reached by health services.

A second syringe collection campaign, expanded to include more cities, was carried out in 2018. By analysing trends over time, the network will aim to detect changing patterns of injecting. Future collection campaigns will further harmonise the sampling strategy, the type of syringes collected and the list of substances tested across cities. Future campaigns should also aim at collecting syringes from other settings and including more cities in order to provide a more representative picture of the European situation and to advance knowledge on local injecting practices.

Pros and cons of the method

The method used in this study:

+ provides timely local information on injected substances and patterns of injection to health and social services, allowing for prompt response to potentially dangerous substances;
+ provides analytically confirmed information that can complement existing monitoring tools based on self-reports from users;
+ provides information on injecting practices of groups of people who inject drugs that are not reached by drug treatment services;
+ can potentially detect changes in injected substances if repeated over time;
– can be costly and resource-intensive in terms of syringe collection, transport, sample preparation and laboratory analysis;
– requires strict safety measures;
– requires strong laboratory and analytical chemistry expertise;
– does not replace surveys among drug users.

ESCAPE network

City	Names	Institutions	Logo
Amsterdam	Tibor Brunt	Trimbos instituut	
	Toon Broeks	MAINline	
Budapest	Klára Keveházi	Hungarian Interchurch Aid	
	József Csorba		
	Tamás Figeczki		
Glasgow	Dr Andrew McAuley	Health Protection Scotland / Glasgow Caledonian University	
	Denise McKeown	University of Glasgow	
	Dr Hazel Torrance		
	John Campbell	NHS Greater Glasgow and Clyde	
	Dr Carole Hunter		
Helsinki	Teemu Gunnar	National Institute for Health and Welfare	
	Anne Arponen		
Lausanne	Elodie Lefrançois	Université de Lausanne	
	Pierre Esseiva	Université de Lausanne	
	Marc Augsburger	CHUV	
Paris	Sara Karolak	Paris Sud University	
	Aziz Kinani		
	Maya Bimbot		
	Yves Levi		
	Catherine Duplessy	association SAFE	
	Julien Van der Elst		
	Bienvenue Mbadu Kambu		
	Thierry Grandidier		
Scientific coordination	Thomas Néfau	Observatoire Français des drogues et des toxicomanies	

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Appendices

APPENDIX 1:

List of drugs, adulterants and metabolites tested for, by city, ESCAPE 2017

Group	Substance	Amsterdam (1)	Budapest (1)	Glasgow (2)	Helsinki (3)	Lausanne (1)	Paris (4)
Amphetamines	Amphetamine	x	x	x	x	x	x
	Methamphetamine	x	x	x	x	x	x
Cocaine	Cocaine	x	x	x	x	x	x
Heroin	Heroin	x	x	x	x	x	x
Morphine	Morphine	x	x	x	x	x	x
Buprenorphine	Buprenorphine	x	x	x	x	x	x
Naloxone	Naloxone	x	x		x	x	x
Methadone	Methadone	x	x	x	x	x	x
Fentanyl and derivatives	3-methylfentanyl	x	x		x	x	
	4-Chloro-isobutyrfentanyl	x	x	x	(x)	x	
	4-Fluoro-isobutyryl fentanyl	x	x	x	(x)	x	
	4-Methoxy-butyryl fentanyl	x	x	x	(x)	x	
	Acetylfentanyl	x	x	x	x	x	x
	Acrylfentanyl	x	x	x	x	x	
	Alfentanil	x	x	x	x	x	
	Butyrylfentanyl	x	x	x	(x)	x	
	Carfentanil	x	x	x	x	x	x
	Cyclopentylfentanyl	x	x	x	(x)	x	
	Cyclopropylfentanyl	x	x	x	(x)	x	
	Despropionylfentanyl	x	x	x	(x)	x	
	Fentanyl	x	x	x	x	x	x
	Furanyl fentanyl	x	x	x	x	x	x
	Ocfentanyl	x	x	x	x	x	x
	ortho-Fluorofentanyl	x	x	x	(x)	x	
	Valerylfentanyl	x	x	x	(x)	x	
Other opioids	AH-7921	x	x	x	(x)	x	
	Codeine	x	x	x	x	x	x
	Dihydrocodeine	x	x	x	x	x	
	Hydrocodone	x	x		x	x	
	Oxycodone	x	x		x	x	
	Tramadol	x	x	x	x	x	x
	U-47,700	x	x	x	x	x	x

Group	Substance	Amsterdam (1)	Budapest (1)	Glasgow (2)	Helsinki (3)	Lausanne (1)	Paris (4)
Cathinones	3-MMC	x	x	x	x	x	x
	3,4-DMMC	x	x		x	x	
	4-Chloro-alpha-PVP	x	x		x	x	
	4-Chloroethcathinone	x	x		x	x	
	4-Chloromethcathinone	x	x	x	(x)	x	
	4-Fluoro-alpha-PVP	x	x		x	x	
	4-MEC	x	x	x	x	x	x
	alpha-PHP	x	x		x	x	
	alpha-PHPp	x	x		x	x	
	alpha-PVP	x	x	x	x	x	x
	bk-MDDMA	x	x		x	x	
	Buphedrone (MABP)	x	x		x	x	
	Butylone (bk-MDMB)	x	x	x	x	x	
	Ethylone (bk-MDEA)	x	x	x	x	x	
	MDPBP	x	x		x	x	
	MDPV	x	x	x	x	x	x
	Mephedrone (4-MMC)	x	x	x	x	x	x
	Methedrone (bk-PMMA)	x	x		x	x	
	Methylone	x	x	x	x	x	x
	Mexedrone	x	x	x	(x)	x	
	Naphyrone	x	x	x	(x)	x	
	N-ethylhexedrone	x	x		(x)	x	
	Pentedrone	x	x	x	x	x	x
Synthetic cannabinoids	4CN-Cumyl-BINACA		x		x		
	5F-APINACA	x	x		x	x	
	5F-MDMB-PINACA	x	x		(x)	x	
	5F-PB-22	x	x		x	x	
	AB-CHMINACA	x	x		x	x	
	AB-FUBINACA	x	x		x	x	
	AMB-FUBINACA	x	x		(x)	x	

Group	Substance	Amsterdam (1)	Budapest (1)	Glasgow (2)	Helsinki (3)	Lausanne (1)	Paris (4)
Benzodiazepines	3OH-Phenazepam	x	x	x	x	x	
	Alprazolam	x	x	x	x	x	x
	Bromazepam	x	x		x	x	
	Chlordiazepoxide	x	x	x	x	x	
	Clobazam	x	x		x	x	
	Clonazepam	x	x	x	x	x	x
	Clonazolam	x	x	x	(x)	x	
	Delorazepam	x	x	x	(x)	x	
	Deschloroetizolam	x	x	x	x	x	
	Desmethyldiazepam	x	x	x	x	x	
	Diazepam	x	x	x	x	x	x
	Diclazepam	x	x	x	x	x	
	Etizolam	x	x	x	x	x	x
	Flubromazepam	x	x	x	x	x	
	Flubromazolam	x	x	x	(x)	x	
	Flunitrazepam	x	x		x	x	x
	Lorazepam	x	x	x	x	x	
	Lormetazepam	x	x	x	(x)	x	
	Meclonazepam	x	x	x	(x)	x	
	Metizolam	x	x	x	(x)	x	
	Midazolam	x	x	x	x	x	x
	Nifoxipam	x	x	x	x	x	
	Nitrazepam	x	x	x	x	x	
	Oxazepam	x	x	x	x	x	x
	Phenazeam	x	x	x	x	x	
	Pyrazolam	x	x	x	x	x	
	Temazepam	x	x	x	x	x	x
Piperidines	2-DPMP		x		x		
	3,4-CTMP		x		x		
	4-Fluoro-methylphenidate	x	x		x	x	
	Ethylphenidate	x	x	x	x	x	x
	Methylphenidate	x	x	x	x	x	x
MDMA	MDA	x	x	x	x	x	
	MDEA	x	x	x	x	x	
	MDMA	x	x	x	x	x	x
Ketamine	Ketamine	x	x	x	x	x	x
Other medications	Bupropion	x	x		x	x	
	Carbamazepine	x	x		x	x	
	Gabapentin	x	x		x	x	
	Methiopropamine	x	x	x	x	x	x
	Methotrexate	x	x		(x)	x	x
	Pregabalin	x	x		x	x	
	Quetiapine	x	x		x	x	
	Tiapride	x	x		(x)	x	
	Tizanidine	x	x		x	x	
	Zolpidem	x	x	x	x	x	x
	Zopiclone	x	x	x	x	x	x

Group	Substance	Amsterdam (1)	Budapest (1)	Glasgow (2)	Helsinki (3)	Lausanne (1)	Paris (4)
Other amphetamines	3-Fluoromethamphetamine	x	x		x	x	
	4-Fluoro-amphetamine	x	x		x	x	x
	N-propylamphetamine	x	x		(x)	x	
	PMA	x	x		x	x	
	PMMA	x	x		x	x	
Other drugs	5-EAPB	x	x		x	x	
	Mephtetramine	x	x		x	x	
Metabolites	6-monoacetylmorphine (heroin)	x	x	x	x	x	x
	7-Aminoclonazepam (clonazepam)	x	x		x	x	
	7-Aminoflunitrazepam (flunitrazepam)	x	x		x	x	
	7-Aminonitrazepam (nitrazepam)		x		x		
	10-monohydroxycarbamaze-pine (carbamazepine)	x	x		x	x	
	α-hydroxy-alprazolam (alprazolam)	x	x		x	x	
	α-hydroxy-midazolam (midazolam)	x	x		x	x	
	Acetylcodeine (heroine)	x	x		x	x	
	Benzoylecgonine (cocaine)	x	x	x	x	x	x
	EDDP (methadone)	x	x		x	x	
	HMMA (MDMA)	x	x		x	x	
	norbuprenorphine (buprenorphine)	x	x		x	x	
	O-desmethyltramadol (tramadol)	x	x		x	x	
Adulterants	Caffeine	x	x			x	
	Dextromethorphan	x	x	x	x	x	x
	Griseofulvine	x	x			x	
	Hydroxyzine	x	x		x	x	
	Levamisole	x	x	x	x	x	x
	Lidocaine	x	x			x	
	Paracetamol	x	x			x	
	Phenacetin	x	x			x	

(1) Screening method — gas chromatography/mass spectrometry detection.
(2) Target method — high performance liquid chromatography/mass spectrometry detection.
(3) Target method — high performance liquid chromatography/tandem mass spectrometry + ultra-high performance liquid chromatography/quadrupole time-of-flight (QToF) detection (only if there were no positive findings with the first analytical method). Substances with 'x' in brackets were only screened with the second analytical method (QToF).
(4) Target method — high performance liquid chromatography/tandem mass spectrometry detection.

APPENDIX 2:
Number and percentage of syringes by substance and drug group detected, by city, ESCAPE 2017

Group	Substance	Amsterdam (N = 81)		Budapest (N = 226)		Glasgow (N = 195)		Helsinki (N = 284)		Lausanne (N = 233)		Paris (N = 259)	
		count	%	count	%	count	%	count	%	count	%	count	%
Amphetamines	Amphetamine	0	0.00	33	14.60	0	0.00	101	35.56	0	0.00	0	0.00
	Methamphetamine	0	0.00	0	0.00	20	10.26	136	47.89	0	0.00	3	1.16
	Total	**0**	**0.00**	**33**	**14.60**	**20**	**10.26**	**150**	**52.82**	**0**	**0.00**	**3**	**1.16**
Cocaine	**Cocaine**	**35**	**43.21**	**0**	**0.00**	**156**	**80.00**	**11**	**3.87**	**168**	**72.10**	**66**	**25.48**
Heroin	Heroin	75	92.59	13	5.75	53	27.18	0	0.00	79	33.91	32	12.36
	Morphine + 6-MAM (without heroin)	2	2.47	0	0.00	42	21.54	0	0.00	4	1.72	12	4.63
	Codeine + 6-MAM (without heroin)	2	2.47	0	0.00	27	13.85	0	0.00	2	0.86	1	0.39
	Total	**77**	**95.06**	**13**	**5.75**	**95**	**48.72**	**0**	**0.00**	**83**	**35.62**	**44**	**16.99**
Morphine	**Morphine (without heroin)**	**1**	**1.23**	**0**	**0.00**	**4**	**2.05**	**0**	**0.00**	**13**	**5.58**	**37**	**14.29**
Buprenorphine	**Buprenorphine**	**0**	**0.00**	**4**	**1.77**	**0**	**0.00**	**163**	**57.39**	**0**	**0.00**	**22**	**8.49**
Naloxone	Naloxone	0	0.00	0	0.00	0	0.00	32	11.27	0	0.00	0	0.00
Methadone	**Methadone**	**4**	**4.94**	**0**	**0.00**	**0**	**0.00**	**4**	**1.41**	**5**	**2.15**	**0**	**0.00**
Fentanyl and derivatives	Acetylfentanyl	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Carfentanil	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Fentanyl	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Furanyl fentanyl	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Ocfentanyl	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Other opioids	Codeine (without heroin)	1	1.23	0	0.00	4	2.05	2	0.70	4	1.72	1	0.39
	Oxycodone (H)	0	0.00	0	0.00	0	0.00	4	1.41	0	0.00	0	0.00
	Tramadol	0	0.00	0	0.00	0	0.00	2	0.70	0	0.00	0	0.00
	U-47,700	0	0.00	0	0.00	0	0.00	1	0.35	0	0.00	0	0.00
	Total	**1**	**1.23**	**0**	**0.00**	**4**	**2.05**	**9**	**3.17**	**4**	**1.72**	**1**	**0.39**

Group	Substance	Amsterdam (N = 81)		Budapest (N = 226)		Glasgow (N = 195)		Helsinki (N = 284)		Lausanne (N = 233)		Paris (N = 259)	
		count	%	count	%	count	%	count	%	count	%	count	%
Cathinones	3-MMC	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	87	33.59
	4-Cl-alpha-PVP (B,H)	0	0.00	102	45.13	0	0.00	4	1.41	0	0.00	0	0.00
	4-Chloroethcathinone (4-CEC) (H)	0	0.00	1	0.44	0	0.00	3	1.06	0	0.00	0	0.00
	4-Chloromethcathinone (4-CMC) (B)	0	0.00	14	6.19	0	0.00	0	0.00	0	0.00	0	0.00
	4-F-alpha-PVP (H)	0	0.00	0	0.00	0	0.00	1	0.35	0	0.00	0	0.00
	4-methylethcathinone (4-MEC)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	61	23.55
	alpha-PHP (B,H)	0	0.00	24	10.62	0	0.00	3	1.06	0	0.00	0	0.00
	alpha-PVP	0	0.00	0	0.00	0	0.00	11	3.87	0	0.00	0	0.00
	Ethylone (bk-MDEA) (H)	0	0.00	0	0.00	0	0.00	2	0.70	0	0.00	0	0.00
	MDPV	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Mephedrone (4-MMC)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	87	33.59
	Methylone	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	N-ethylhexedrone (B)	0	0.00	171	75.66	0	0.00	0	0.00	0	0.00	0	0.00
	Pentedrone (P)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Total	**0**	**0.00**	**180**	**79.65**	**0**	**0.00**	**16**	**5.63**	**0**	**0.00**	**113**	**43.63**
Synthetic cannabinoids	5F-MDMB-PINACA	0	0.00	1	0.44	0	0.00	0	0.00	0	0.00	0	0.00
	AMB-FUBINACA	0	0.00	4	1.77	0	0.00	0	0.00	0	0.00	0	0.00
	Total	**0**	**0.00**	**5**	**2.21**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**
Benzodiazepines	Alprazolam	0	0.00	0	0.00	0	0.00	3	1.06	0	0.00	0	0.00
	Clonazepam	0	0.00	0	0.00	0	0.00	7	2.46	1	0.43	0	0.00
	Diazepam	0	0.00	0	0.00	1	0.51	2	0.70	0	0.00	0	0.00
	Etizolam	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Flunitrazepam (P)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Midazolam	0	0.00	0	0.00	0	0.00	15	5.28	53	22.75	0	0.00
	Oxazepam (H)	0	0.00	0	0.00	0	0.00	1	0.35	0	0.00	0	0.00
	Temazepam (H)	0	0.00	0	0.00	0	0.00	7	2.46	0	0.00	0	0.00
	Total	**0**	**0.00**	**0**	**0.00**	**1**	**0.51**	**32**	**11.27**	**54**	**23.18**	**0**	**0.00**

Group	Substance	Amsterdam (N = 81)		Budapest (N = 226)		Glasgow (N = 195)		Helsinki (N = 284)		Lausanne (N = 233)		Paris (N = 259)	
		count	%	count	%	count	%	count	%	count	%	count	%
Piperidines	4-Fluoromethylphenidate (H)	0	0.00	0	0.00	0	0.00	1	0.35	0	0.00	0	0.00
	Ethylphenidate	0	0.00	0	0.00	0	0.00	0	0.00	2	0.86	10	3.86
	Methylphenidate	0	0.00	0	0.00	0	0.00	6	2.11	0	0.00	1	0.39
	Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**7**	**2.46**	**2**	**0.86**	**10**	**3.86**
MDMA	**MDMA**	**1**	**1.23**	**0**	**0.00**	**22**	**11.28**	**8**	**2.82**	**3**	**1.29**	**0**	**0.00**
Ketamine	**Ketamine**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**6**	**2.11**	**0**	**0.00**	**0**	**0.00**
Other medications	Bupropion (H)	0	0.00	0	0.00	0	0.00	8	2.82	0	0.00	0	0.00
	Carbamazepine (H)	0	0.00	0	0.00	0	0.00	2	0.70	0	0.00	0	0.00
	Gabapentin (H)	0	0.00	0	0.00	0	0.00	15	5.28	0	0.00	0	0.00
	Methotrexate (P)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.77
	Pregabalin (H)	0	0.00	0	0.00	0	0.00	26	9.15	0	0.00	0	0.00
	Quetiapine (H)	0	0.00	0	0.00	0	0.00	2	0.70	0	0.00	0	0.00
	Tiapride (B)	0	0.00	1	0.44	0	0.00	0	0.00	0	0.00	0	0.00
	Tizanidine (H)	0	0.00	0	0.00	0	0.00	4	1.41	0	0.00	0	0.00
	Zolpidem	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Zopiclone	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Total	**0**	**0.00**	**1**	**0.44**	**0**	**0.00**	**53**	**18.66**	**0**	**0.00**	**2**	**0.77**
Amphetamine-like substances	3-FMA (H)	0	0.00	0	0.00	0	0.00	3	1.06	0	0.00	0	0.00
	4-FA (P)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	Methiopropamine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
	N-Propylamphetamine (B)	0	0.00	22	9.73	0	0.00	0	0.00	0	0.00	0	0.00
	Total	**0**	**0.00**	**22**	**9.73**	**0**	**0.00**	**3**	**1.06**	**0**	**0.00**	**0**	**0.00**

Group	Substance	Amsterdam (N = 81)		Budapest (N = 226)		Glasgow (N = 195)		Helsinki (N = 284)		Lausanne (N = 233)		Paris (N = 259)	
		count	%	count	%	count	%	count	%	count	%	count	%
Cutting agents	Caffeine (A,B,L)	66	81.48	40	17.70	0	0.00	0	0.00	144	61.80	0	0.00
	Dextromethorphane	0	0.00	0	0.00	1	0.51	2	0.70	0	0.00	0	0.00
	Griseofulvine (A,L)	0	0.00	6	2.65	0	0.00	0	0.00	8	3.43	0	0.00
	Hydroxyzine (A,H,L)	3	3.70	0	0.00	0	0.00	1	0.35	1	0.43	0	0.00
	Levamisole	21	25.93	0	0.00	19	9.74	1	0.35	127	54.51	0	0.00
	Lidocaine (A,L)	1	1.23	0	0.00	0	0.00	0	0.00	35	15.02	0	0.00
	Paracetamol (A,L)	17	20.99	13	5.75	0	0.00	0	0.00	77	33.05	0	0.00
	Phenacetin (A,L)	28	34.57	0	0.00	0	0.00	0	0.00	107	45.92	0	0.00
	Total	**79**	**97.53**	**53**	**23.45**	**20**	**10.26**	**4**	**1.41**	**208**	**89.27**	**0**	**0.00**
Metabolites	6-MAM (without heroin/morphine/codeine)	1	1.23	0	0.00	2	1.03	0	0.00	5	2.15	0	0.00
	7-Aminoclonazepam (H)	0	0.00	0	0.00	0	0.00	7	2.46	0	0.00	0	0.00
	10-Monohydroxycarbamazepine (H)	0	0.00	0	0.00	0	0.00	1	0.35	0	0.00	0	0.00
	EDDP (H)	0	0.00	0	0.00	0	0.00	2	0.70	0	0.00	0	0.00
	Benzoylecgonine (H,P)	0	0.00	0	0.00	148	75.90	5	1.76	0	0.00	53	20.46
	Total	**1**	**1.23**	**0**	**0.00**	**149**	**76.41**	**15**	**5.28**	**5**	**2.15**	**53**	**20.46**

Substances tested for only in some cities are denoted by the first letter of those cities.

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emcdda

About this publication

Rapid communications bring you the latest findings and discussions in key areas in the drugs field. This report presents the results of an innovative method for gathering information on the substances used by people who inject drugs. In this pilot study, chemical analysis of the contents of used syringes collected from exchange sites reveals the drugs and drug combinations injected in the six participating European cities. This approach can provide local and timely information that can be used for city-level monitoring and interventions.

About the EMCDDA

The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) is the central source and confirmed authority on drug-related issues in Europe. For over 20 years, it has been collecting, analysing and disseminating scientifically sound information on drugs and drug addiction and their consequences, providing its audiences with an evidence-based picture of the drug phenomenon at European level.

The EMCDDA's publications are a prime source of information for a wide range of audiences including: policymakers and their advisors; professionals and researchers working in the drugs field; and, more broadly, the media and general public. Based in Lisbon, the EMCDDA is one of the decentralised agencies of the European Union.

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