European Monitoring Centre
for Drugs and Drug Addiction

Drug checking as a harm reduction tool for recreational drug users: opportunities and challenges

Background paper commissioned by the EMCDDA for
Health and social responses to drug problems: a European guide

Author
T. Brunt

2017

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Dr Tibor Brunt
Drug Information and Monitoring System, the Netherlands

version: 30 October 2017

This paper was commissioned by the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) to provide background information to inform and contribute to the drafting of Health and social responses to drug problems: a European guide.

This background paper was produced under contract CT.16.SDI.0147.1.0 and we are grateful for the valuable contribution of the author. The paper has been cited within Health and social responses to drug problems and is also being made available online for those who would like further information on the topic. However, the views, interpretations and conclusions set out in this publication are those of the author and are not necessarily those of the EMCDDA or its partners, any EU Member State or any agency or institution of the European Union.

1. Introduction

The use of illicit drugs is an ongoing political, legal, economic and health issue. The use of most illicit drugs poses several health risks, which can lead to problems and the need for medical treatment. To mitigate these health problems, most European countries have prohibited (non-prescription) drugs of abuse under international conventions (UNODC, 2013). These treaties are directed at the prohibition of the manufacture, distribution and possession of listed substances. This strategy is also referred to as the 'supply reduction' approach in drug policy (Caulkins and Reuter, 1997). Alongside this effort, some European countries have also adopted more pragmatic drug policies, which acknowledge that illicit drugs will be used despite legal attempts to limit their availability. Such policies aim to reduce harm to users and society by offering specialised services to drug users, referred to as the 'harm reduction' approach (Marlatt et al., 2012). A good example of a harm reduction strategy is syringe exchange programmes, which originated in 1984 in Amsterdam as a measure to stop the spread of the hepatitis B virus and the human immunodeficiency virus (HIV) among injecting drug users and has since been adopted globally in an attempt to prevent the transmission of viral blood-borne diseases in this group and their social environment (Hartgers et al., 1989). Other examples of harm reduction approaches include heroin-assisted treatment and safe injection rooms for chronic, often treatment-refractory, drug users (Kerr et al., 2007; Blanken et al., 2010).

Originally, syringe exchange programmes and injection rooms were principally aimed at problematic, marginalised drug users. However, the drug users that have followed in the slipstream of the electronic dance music revolution of the early 1990s and changing nightlife settings are not characterised by high unemployment or major problems in other areas. Rather, most people who use drugs in such recreational settings have relatively few drug-related problems and do not differ much from those who do not use drugs, except for their predilection for nightlife and a hedonistic lifestyle (Tossmann et al., 2001; Butler and Montgomery, 2004). In western Europe, this trend is characterised by the increasing popularity of many stimulant drugs that boost energy and self-confidence (Boys et al., 2001). These include both well-known

illicit drugs and novel stimulants. In addition, novel psychedelics have also regained popularity, especially among the young and highly educated, whose reason for using drugs is typically to expand their horizons (Orsolini et al., 2015). The often unknown nature of these substances and the settings in which they are taken, such as crowded nightclubs or large and densely populated dance events, bring their own specific risks. So, in contrast to chronic and compulsive drug use, treatment of which addresses dependence and withdrawal, an incidental (or recreational) pattern of drug use might necessitate the treatment of acute intoxication symptoms. The goal of reducing acute harms among drug users at dance events and clubs has led to the spread worldwide of initiatives such as the provision of good ventilation, accessible drinking water and chill-out spots and the presence of first aid teams in such settings (Bellis et al., 2002). In addition, because, in many cases, the dose and contents of these substances are unknown, and because users are unfamiliar with the effects of many of these substances, additional harm reduction initiatives directed at recreational users, such as drug-testing (or drug-checking) services (Spruit, 1999; Kriener et al., 2001; Spruit, 2001), have been developed.

2. The history and expansion of the drug-checking provision across Europe

The use of ecstasy (3,4-methylenedioxymethamphetamine (MDMA)) and related phenethylamines, but also GHB (gamma-hydroxybutyrate) or ketamine, is associated with effects and risks different from those associated with traditional illicit substances, such as cocaine and heroin. The risks associated with these substances have led to drug checking (or testing) being introduced to the nightlife setting as a harm reduction strategy across Europe and the United States. In 1992, in the Netherlands, the Ministry of Health decided to fund the first drug-checking system in Europe, the Drug Information and Monitoring System (DIMS), housed at the Trimbos Institute (Spruit, 1999). DIMS was established as a scientific project to monitor new and existing drug markets with respect to dose, composition, adulterants and availability. It is a nationwide system of stationary testing facilities, embedded in different regional institutes of prevention and addiction care (for an elaborate description of methods, see Brunt and Niesink, 2011). It closely mirrors a system of pharmacovigilance and also reports collected data to the European Union (EU) Early Warning System (EWS) (EMCDDA and Europol, 2007).

Following in the footsteps of this Dutch initiative, drug-checking systems have been set up by other countries in western Europe. In Austria, a mobile onsite drug-checking service (Check It) was set up in 1997, supported by the municipality of Vienna and the Austrian government (Kriener et al., 2001). In 2001, the Swiss also introduced a similar mobile testing unit, funded by the municipality of Zürich (Bücheli et al., 2010). In Belgium, funded by the municipality of Wallonia-Brussels, a small-scale drug-testing initiative started in 1993 (Modus Vivendi). In Spain, a simple on-site drug-testing initiative started in 1997. Subsequently, a stationary testing facility, Energy Control, incorporating advanced chemical analysis techniques, partly financed by the government, was established (Energy Control, 2017). Drug samples collected throughout Spain can be sent to this facility. The late 1990s also saw the establishment, in France, of SINTES (National Detection System of Drugs and Toxic Substances), which allows drug samples collected voluntarily from drug users at any location to be sent to an analytical forensic chemical laboratory (Giraudon and Bello, 2007). In 2001, a Portuguese on-site drug-testing service (Check !n) was introduced at festivals, partly funded by the government (Martins et al., 2015). Most recently, in 2009, Wales introduced a drug-testing initiative called WEDINOS, which is financed by the United Kingdom National Health Service (NHS Wales, 2015). Users can anonymously send in drug samples and receive test results online. Outside Europe, in the United States, a small-scale drug-testing system (DanceSafe) enables the results of the analysis of ecstasy pills to be shared on the internet (Tanner-Smith, 2006). In addition, several other European countries are considering drug-testing services or have already started to offer such services (Figure 1).

Figure 1

European drug-checking services in existence in 2017

3. The types of drug-checking services available and their pros and cons

Although most drug-checking services have been adopted for harm reduction purposes, they operate individually, and the chemical drug analysis techniques used vary considerably. An international collaborative effort between 2011 and 2013, the Trans European Drug Information (TEDI) project, combined data from the drug-checking systems of Spain, Switzerland, Belgium, Austria, Portugal and the Netherlands to compare results and exchange knowledge about the different analysis techniques used (Brunt et al., 2017). In summary, based on the available funds, the techniques used vary from colorimetric reagents (not expensive, but inaccurate) to advanced gas chromatography (GC) coupled to mass spectrometry (GC/MS), GC coupled to mass spectrometry coupled to mass spectrometry (GC/MS/MS) or GC coupled to quantitative time-of-flight mass spectrometry (GC/QToF/MS) (expensive and very accurate). However, the laboratory techniques used are also dependent on the setting.

Stationary testing facilities, for example a certified immobile laboratory, are able to put a whole range of advanced chemical analysis techniques at the disposal of the drug-checking service. However, some drug-checking services (e.g. Check It, Austria; Safer Dance, Switzerland; Check !n, Portugal) aim to test drugs on the spot in clubs or at dance events and to immediately communicate the results to consumers. In such cases, it is usually not possible to provide extensive, state-of-the-art laboratory facilities. For this reason, Check It and Safer Dance make use of mobile high-performance liquid chromatography (HPLC) devices. However, a back-up laboratory is available to further analyse samples if a compound is not adequately identifies by HPLC alone. An overview of TEDI's drug-checking services and the corresponding laboratory techniques used is given in Table 1.

Table 1. Different laboratory methods used by a sample of European drug-testing services that are part of the TEDI project

Method	Drug-testing service				
	Check !n (Portugal)	**Energy Control (Spain)**	**DIMS (Netherlands)**	**Safer Dance (Switzerland)**	**Check It (Austria)[a]**
TLC	X	X	—	—	—
LC/ESI/QToF	—	X[b]	—	—	—
LC/ESI/MS/MS	—	X	—	—	—
LC/ESI/MS	—	X	X	—	—
LC/DAD	—	—	X	X	X
GC/FID	—	—	X	—	—
GC/MS	—	X	X	X	X
GC/MS/MS	—	—	X	X	X
NMR	—	X[b]	X[b]	—	X[b]
HPLC	—	X	—	X	X

Notes: For further descriptions of these techniques, see Brunt et al. (2017).
([a]) Check It works in close collaboration with a laboratory that uses more elaborate laboratory methods.
([b]) Only when requested for specialised analysis.
DAD, diode array detection; ESI, electrospray ionisation; FID, flame ionisation detection; NMR, nuclear magnetic resonance; TLC, thin-chromatography.

The nature of a drug-checking service affects the accuracy and reliability of the analysis results and, therefore, the extent of harm reduction. Simply put, do you merely want to demonstrate the presence or absence of a main component in a drug sample or do you want to provide quantitative information about all compounds in a drug sample to a consumer? Existing drug-checking services offer either of these two extreme options or a service somewhere in between, depending on the available funds, the goals and the type of service provided (or allowed). An overview of the different types of drug-checking services and the implications for testing reliability and accuracy, preventive function and the potential for harm reduction is given in Figure 2.

Figure 2

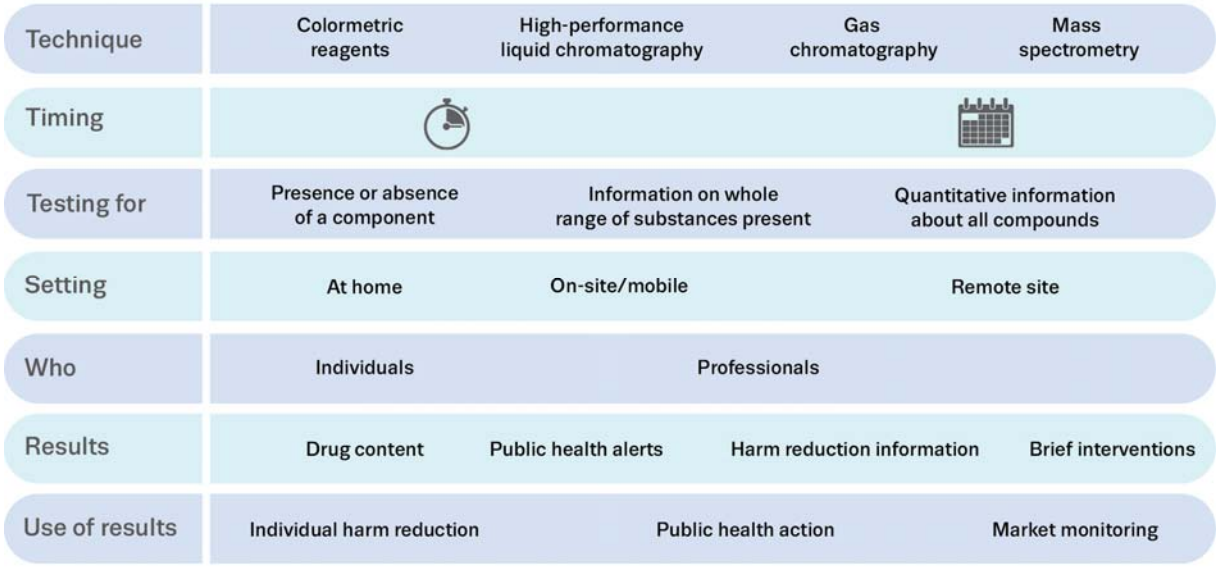
General utility of current types of drug-testing methods used

Finally, the specific aims can differ across the different drug-testing agencies. DIMS is primarily a monitoring instrument that aims to gain information about the drug market for policy purposes and surveillance. This could result in either targeted warnings to a specific user group or mass media campaigns aimed at the general public in the case of compounds that pose additional risks, which depends on toxicity information and the potential geographical spread of the drugs in question. Most other systems publish all of their analysis results on information boards at dance events (Check It and Safer Dance) or post them online for all potential drug users to read (DanceSafe: www.ecstasy.org). In addition, depending on the system, warnings are issued nationally or internationally (e.g. to the EWS). What is considered to be a hazardous content of a drug sample by one system might not automatically be considered hazardous by another. Finally, Energy Control recently piloted a project whereby drugs purchased by consumers on cryptomarkets ([1]) could be submitted for analysis (Caudevilla et al., 2016). The results were anonymously reported back to the consumer. Figure 3 gives a brief summary of some of the methodologies used, the

([1]) A cyptomarket is a marketplace that hosts multiple sellers or 'vendors', is located on the hidden web (dark web or dark net) and uses cryptocurrencies (e.g. Bitcoin) for payment, providing participants with an anonymous way of purchasing goods, legal or illegal.

aims and types of interventions, and how these are linked to the drug-checking results.

Figure 3
Ways in which drug checking services can vary



3.1 Pros: an efficient strategy to promote the health of and reduce harms to drug users

How can drug checking help to reduce harm related to drug use? Firstly, it is important to bear in mind that many drug-checking initiatives were introduced with the aim of extending prevention activities to young recreational drug users, a group that was not being reached by many national institutions for prevention and addiction care. Traditionally, most of those institutions either were specialised in prevention on a broader societal level or directed harm reduction activities towards problematic and marginalised groups of drug users. By introducing drug checking, such institutions found a way of establishing contact with the emerging group of young, recreational drug users with the aim of providing prevention and harm reduction activities. Drug-checking systems, with their guaranteed anonymity and confidentiality, are considered trustworthy by many young recreational drug users, as individual harm reduction advice potentially serves the needs of this group better than simple promotion of complete abstention (Gamma et al., 2005; Fernández-Calderón et al., 2014).

Secondly, government-advocated messages, often viewed as scare tactics, are considered tendentious and untrustworthy, and conflict with the individual's idea of

self-regulation (Ritter, 2010). Personal contacts with well-informed peers or professionals employed by drug-checking services are believed to be much more effective at persuading drug users to pay attention to preventive information and change their behaviour positively (Allott et al., 1999; Falck et al., 2004; Toumbourou et al., 2007). In addition, drug checking might serve as an immediate intervention tool to change an individual's drug use if drugs are shown to contain unwanted or unknown chemical compounds (Johnston et al., 2006; Fernández-Calderón et al., 2014).

3.2 Criticism: cons of the different types of drug-checking services

Although there are arguments in favour of drug checking, the strategy has also met with much criticism. For instance, it could give drug users an unjustified feeling of safety about the drugs they are taking: the absence of unexpected or acute toxicological compounds in no way guarantees that a drug is safe (Winstock et al., 2001). Every form of drug use is potentially hazardous, and there is no way to completely eradicate the risk. However, when drug checking is thoroughly embedded in a prevention unit, staff have to the opportunity to communicate scientific information about the test results and educate users about general drug risks, thereby eliminating this false sense of security.

It is also important to bear in mind that there are different types of drug-checking services (Figures 2 and 3). Although on-site drug checking might very well work in terms of transferring warnings and offering prevention advice, even entailing counselling or motivational interviewing, the noisy atmosphere at large venues is often a challenge, reducing the effectiveness of this tactic. Moreover, users in such settings might already be under the influence of substances. For this reason, in the Netherlands, drug checking at stationary offices has become the usual practice, often on uneventful weekdays. This gives prevention professionals the opportunity to speak with drug users in a quiet environment, and provides possibilities for motivational counselling. In fact, nowadays, many young drug users seem to purchase drugs from alternative sources, rather than from dealers at events (Global Drug Survey, 2016), making it possible for them to have their drugs tested before consumption at such events. Another practical drawback of onsite drug-checking

services that use crude and inaccurate ‘quick tests’ is that such tests often lead to unreliable or meaningless results, which nullify the harm reduction function.

It could also be argued that drug testing might be misused by vendors or dealers, by providing them with information about purity which they can use to promote their products. Although proper scientific evidence for this is lacking, one DIMS study found that drug-testing results are often published on the internet (e.g. www.pillreports.net, www.partyflock.nl) to inform others about the purity or chemical contents of certain pills (Vrolijk et al., 2017). The possibility that the reason for publishing this information is in fact to promote and sell products cannot be excluded.

It has previously been suggested that drug users will consume the drugs they have purchased regardless of the analysis outcome (Winstock et al., 2001). This argument is refuted by studies reporting that 25 to 100 % of drug users will discard their drugs if they learn that they contain unwanted or unexpected harmful compounds (Stevens, 2017; Measham, in press). However, when considering this finding, the type of drug-testing service should also be taken into account. It seems a valid argument that on-site testing might not prevent people from using questionable drugs, since in this case the user is already at a dance event or a club and will have less opportunity to obtain other drugs in the event of an unexpected result.

Another common criticism is that drug testing encourages young people to take drugs, or to take more drugs than they would if such services were not available. This criticism appears to be unfounded, and, in fact, it has been shown that drug use does not increase following the introduction of a drug-testing service in a country (Bücheli et al., 2010). In addition, the prevalence of drug use does not seem to be higher in countries that have drug-checking systems in place (EMCDDA, 2016). In addition, previous research has shown that drug users who use testing services do not use more drugs than drug users who do not do so (Benschop et al., 2002). In fact, the same study also found that the presence of drug-checking services did not encourage those who do not use drugs to begin drug use.

4. Can drug checking save lives?

Another interesting question that has been raised is whether or not drug checking can save lives. Over the years, there have been cases of certain batches of drugs containing lethal substances causing deaths in countries without a drug-checking service, but not in countries with a drug-checking service that issues public warnings. For example, DIMS recently reported that each of a batch of pink pills bearing a Superman logo contained 170 mg of PMMA (para-methoxymetamphetamine), an unpredictable compound, and one much more toxic compound than MDMA. In the Netherlands and Belgium, this immediately led to national mass media warning campaigns that included national radio and television broadcasts, posts on social media and on the internet, and flyers and posters at large dance events (Keijsers et al., 2008). The Healthy Nightlife Network (prevention professionals, peer coaches) and first aid professionals were also informed. In the United Kingdom, however, where no drug-checking system was in place at the time, the same pills caused the death of four young people (Hill, 2015). This led Professor David Nutt to call for drug checking/pill testing in the United Kingdom (Siddique, 2015). As part of their surveillance function, drug-checking services, by executing warning campaigns, can cause hazardous drugs to be quickly removed from the market, thus creating awareness among drug users and deterring dealers from selling the product (Spruit, 2001). In addition, the chemical composition of illicit drugs seems to correspond more closely to what is expected in countries with drug-checking systems than in countries without such systems, suggesting that drug testing has some kind of influence on the illicit drug market (Kriener et al., 2001; Parrott, 2004).

In recent years there has been a sharp increase in the number of new psychoactive substances (NPS) on the market, presenting drug-checking services with a new challenge (EMCDDA, 2015). The detection and quantification of unknown compounds presents a technical problem, requiring state-of-the-art analytical equipment and software. More important is the challenge of communicating the results of tests of new substances with unknown effects. Here the role of the European Monitoring Centre for Drugs and Drug Addiction's (EMCDDA's) EWS is more important than ever, as it enables information about countless NPS to be quickly gathered and disseminated. Information on NPS reported to the EWS can

readily be picked up by drug-checking systems, and European drug users can be quickly discouraged from taking risky NPS with the potential to cause severe harm or death. For instance, 5-IT (5-(2-aminopropyl)indole) was quickly withdrawn from sale on the internet after it became apparent that this is a deadly compound (EMCDDA, 2014). Another dangerous phenomenon uncovered by drug-checking services is the presence of NPS as adulterants of commonly consumed drugs, such as MDMA, amphetamine or LSD (lysergic acid diethylamide) (Brunt et al., 2017; Martins et al., 2017).

5. Drug policy and the legal challenges in Europe

Certain legal hurdles need to be overcome before a drug-checking service can be established; most importantly, an exemption is required to handle and analyse controlled substances (Home Office, 2014). Such exemptions are issued only in special circumstances (scientific research purposes, pharmaceutical practices or forensic purposes), and many countries do not recognise drug checking as a reason to issue such an exemption. This makes it difficult to establish a drug-checking service , and many attempts to set up such services have not yet surmounted this first jurisprudential hurdle. In addition, the possession of controlled substances is a legal offence in most EU Member States, which technically makes all testing drug users subject to punishment by the rule of law (UNODC, 2013). These are just some of the barriers that must be overcome to even contemplate drug testing, making it a very delicate subject, even in the countries where it is available.

A favourable attitude on the part of government will certainly aid the establishment of a drug-checking service. Another solution adopted in some countries, such as the Netherlands and Austria, is to set up a drug-checking service as a scientific project with primarily research goals rather than as a customer service, as a way of making it acceptable. In the Netherlands, an official agreement with the public prosecution service ensures that anyone possessing illicit drugs at a DIMS drug-testing service will not be arrested or prosecuted (Dutch Second Chamber States General, 1999). This unique agreement makes the testing system possible but also has to be honoured by the police. Without political support, such an arrangement would have been impossible.

These challenges mean that in much of the world, drug testing is a daring and pioneering exercise, but there are signs that the winds might be changing in its favour (Butterfield et al., 2016; Fisher and Measham, 2016; Sage and Michelow, 2016; Ritter, 2017).

6. The future of drug testing in Europe

As described above, accurate drug checking and the quantification of compounds is still limited by the need for advanced and expensive laboratory equipment. Ideally, it needs a laboratory with GC/MS, gas chromatography coupled to flame ionisation detection (GC/FID) or HPLC at the very least (see Table 1). However, most of these techniques require complex sample preparation and specialised operating staff, and take a relatively long time and incur high costs. This automatically implies that accurate and reliable drug testing by a drug-checking service is heavily dependent on sufficient funding. As implied in the discussion about policy, above, this funding will usually have to come from national or regional governmental stakeholders (i.e. the relevant ministry or municipality governance). In fact, the criticism that the results of some drug-checking services are unreliable and of limited utility, which can be attributed to a lack of advanced drug-testing equipment, is a problem not so much of drug checking as of a lack of proper funding. One way of obtaining the required funding that could be viable would be to embed drug checking in the prevention and harm reduction programmes that are rolled out by most countries. This would seem to be a logical solution given that personalised prevention would be facilitated by contact between drug users and prevention specialists at drug-checking services. Another way of obtaining systematic funding would be to use drug checking as a monitoring tool to obtain drug market information, in the same way as DIMS was set up at the end of the 1990s.

Scientific innovation may also further the cause of those who want to implement drug checking, as scientists have been working on simpler and cheaper methods of reliable drug checking. One such technique that seems to be very promising is infrared spectroscopy (Grobério et al., 2015; Penido et al., 2015). As most molecules (e.g. cocaine or MDMA) exhibit a unique pattern (spectra) of absorption of infrared light, it is possible to identify accurately a large range of compounds (i.e. qualitative testing). In addition, quantification is possible by coupling Fourier transform infrared

spectroscopy (FTIR) to a mathematical model that enables the proportions of different compounds in a sample to be determined (Grobério et al., 2015; Eliaerts et al., 2016). Currently, FTIR is being used in the United Kingdom by the drug-checking project 'The Loop' (http://wearetheloop.co.uk/), and DIMS is also using it for analyses. An additional advantage of FTIR is that compact hand-held devices have been developed, making possible on-site drug checking using this technique (Hoffmann et al., 2016).

Despite promising new techniques and innovations, drug checking still faces many challenges posed by the developing drug market. As previously mentioned, the ever-growing list of known NPS requires an advanced understanding of the chemical complexity of these substances and up-to-date spectral databases. Here, again, the EWS of the EMCDDA plays a pivotal role, collecting spectral data (infrared, GC/MS, nuclear magnetic resonance (NMR)) on most of these compounds from around the globe (EMCDDA and Europol, 2007). Crucial input for the EWS database is delivered by the different European forensic institutes and also customs laboratories, which provide the majority of the information. With regard to the technical limitations of different types of drug checking, it should be mentioned that it is not only new compounds that pose a challenge, but also detecting minute concentrations of known compounds. For instance, very low concentrations of atropine in powder cocaine, as has been detected in the past (Boermans et al., 2006), will not be picked up by IR or relatively low-resolution techniques.

Finally, the behaviour of drug users is an ongoing challenge for workers at drug-checking services. Drug checking relies heavily on the presumption that drug users are susceptible to harm reduction advice, yet some groups not seem susceptible to such advice, such as those who participate in 'chemsex' parties (parties at which people take a combination of synthetic drugs and participate in sex, popular with the gay and bisexual communities) (Hockenhull et al., 2017; Schmidt et al., 2016). In addition, harm reduction advice based on drug checking is unable to address polydrug use, as this is associated with risks that are far more unpredictable than those of using one drug alone. For these groups, consideration should be given to combining drug checking and harm reduction advice with behavioural intervention techniques, such as counselling.

7. Conclusions

A number of European countries have implemented drug checking with the aim of providing targeted preventive messages to recreational drug users. This approach, which is more individualised than mass media campaigns, provides an incentive for drug users to participate in a dialogue about prevention and harm reduction, because they get to know the test results, that is they receive information about the particular drugs they are consuming. Pharmacovigilance in the form of drug-checking systems has resulted in timely warning campaigns specifically directed at groups at risk, conveying a level of professionalism that is appreciated by recreational drug users. Such an approach creates more awareness about the specific drugs that are consumed and the options for drug checking. By no means should these arguments in favour of drug testing be considered scientific evidence of its efficacy, but such considerations might be helpful for stakeholders deliberating whether or not to introduce drug testing. Complemented by other activities implemented in nightlife settings, such as chill-out rooms, the provision of factual and trustworthy information, counselling, good ventilation and other precautionary safety measures, drug checking can serve as an extension of prevention and harm reduction interventions, potentially saving lives.

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