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Substance screening in a sample of "clubbers": discrepancies between self-reporting and urinalysis

Luigia Piro[1], Giovanni Martinotti[1], Rita Santacroce[1], Chiara Vannini[1], Chiara Montemitro[1], Raffaele Giorgetti[2], Fabrizio Schifano[3], Silvia Fraticelli[1], Gaia Baroni[1], Massimo di Giannantonio[1]

[1] Department of Neuroscience, Imaging, Clinical Sciences. University "G. d'Annunzio", Chieti-Pescara, Italy; [2] Section of Legal Medicine, Università Politecnica delle Marche, Ancona, Italy: [3] Psychopharmacology, Drug Misuse and Novel Psychoactive Substances Research Unit, School of Life and Medical Sciences, University of Hertfordshire, Hatfield, UK; Section of Legal Medicine, Università Politecnica delle Marche, Ancona, Italy

Abstract

Substance use disorder (SUDs) and addicted behaviours are a serious social and economic issue, becoming increasingly common among the world's population and responsible for a considerable fraction of premature and avoidable deaths among young adults. In recent years, new issues of concern are represented by novel psychoactive substances (NPS) in addition to classic substances of abuse and their massive impact in specific realities, such as Ibiza, the most popular holiday destination for youngsters looking for entertainment; holidays in general and summertime in particular seem to represent a risky time of excess and experimentation, where illicit drugs are typically heavily promoted and widely available. Preliminary studies conducted in Ibiza nightlife resorts highlighted that, in both young tourists and foreign casual workers, risky behaviours appear to be considerably exacerbated, including alcohol and drug use, complex polyabuse and sexual risk taking. Evaluation of illicit drug consumption is supported by two assessment methods: self-reporting questionnaires, mostly used and practice and urinalysis, which is considered the gold standard for detecting the presence of substances but also for monitoring treatments, to support diagnosis and provide an epidemiological basis in studying patterns of drug abuse.

The current study aims at comparing data arising from self-reporting and urinalysis obtained by a sample of subjects admitted to a psychiatric unit after the intake of psychoactive substances for recreational purposes, and at evaluating factors associated with concordance or discordance between the two assessment methods, considering their limitations and strengths.

Introduction

Substance use disorders (SUDs) and addicted behaviours are a serious social and economic issue, with a major adverse impact on public health and welfare worldwide [1-3]. SUDs are becoming increasingly common among the world's population: the prevalence of illicit drug use in Europe and the number of drug-related deaths remain high; moreover, overdosing illicit drugs is responsible for a considerable fraction of premature and avoidable deaths among young adults, accounting for an estimated 4% of all fatalities among those aged 15–39 in Europe [4]. Frequently, fatalities are associated with injecting drugs and, in most cases, involve a combination of substances [4-6]. From 1990 to 2012, between 6100 and 8500 overdose victims were reported each year in Europe. Despite major increases in the provision of drug treatment in Europe, the overall number of reported overdose deaths increased between 2003 and 2008, although it has since fallen back to an estimated 6500 overdose deaths per year in 2012.

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Address for correspondence:

Massimo di Giannantonio
Department of Neuroscience, Imaging, Clinical Sciences, ITAB, University "G.d'Annunzio,
Via Luigi Polacchi
66100 Chieti
E-mail: digiannantonio@unich.it

tive substances (NPS) in addition to classic substances of abuse [7-11]; there is currently a relevant body of clinical evidence to demonstrate the potential acute and chronic health harms associated with the use of NPS, but often very little is known by both consumers and health care professionals [12-15].
The scale of the phenomenon is impressive, but not known in full; for that, an in-depth assessment of substance-use and users is crucial for a global diagnosis and specific treatment plan.
Overall substance use is an undoubtedly global issue, but its impact is much more dramatic in some specific world areas than in any other place: the prime example may be the island of Ibiza, the most popular holiday destination for youngsters looking for entertainment; holidays in general and summertime in particular seem to represent a risky time of excess and experimentation [16]: illicit drugs are typically heavily promoted and widely available, thus, globally increasing revellers engagement in health-endangering behaviours during their stay [17]. Preliminary studies conducted in Ibiza highlighted that, in both young tourists and foreign casual workers, risky behaviours appear to be considerably exacerbated, including alcohol and drug use, complex polyabuse, and sexual risk taking [18-21].
In order to provide a quantitative assessment as accurate as possible with regards to substance consumption, urine testing represents the gold standard for detecting the presence of substances in the management of patients; urinalysis has been used not only for a simple evaluation of samples, but also for monitoring treatments, to support diagnosis and provide an epidemiological basis in studying patterns of drug abuse [22-24]. However, urine test should follow a primary assessment, using self-report measurement techniques [25]. Despite their crucial role in detecting the real impact of illegal drug abuse, both urinalysis and self-report techniques show limitations. Evaluation of illicit substance use based on the subjects self-report is the most widely used and practice [26] for epidemiological research in addictive behaviours because of its main characteristics such as low cost, flexibility, adaptability, efficiency, portability, the possibility to collect data through a variety of technologies (telephone, computer, video) and also the possibility of collecting an abundance of information from many people.
The current study aims at comparing data arising from self-reporting and urinalysis obtained by a sample of subjects admitted to a psychiatric unit after the intake of psychoactive substances for recreational purposes, and at evaluating factors associated with concordance or discordance between the two assessment methods.

Materials and methods

Study subjects and recruitment

48 subjects were enrolled between June 2015 and September 2015, as they were consecutively referred to the *Psychiatric Unit of Can Misses Hospital* (Ibiza, Spain). All the subjects who agreed to participate signed a written informed consent and were primarily evaluated by a team of psychiatrists using the *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (DSM-5) criteria.
Inclusion criteria were: being aged between 18 and 75 years; intake of psychoactive substances or more than five alcohol units during the previous 24 hours. Exclusion criteria included: current presence of delirium tremens or hallucinosis at the moment of clinical interview (possible re-evaluation when clinical conditions improved); epilepsy; severe cardiac failure; diabetes mellitus; severe liver impairment; liver encephalopathy; kidney failure; neoplastic diseases; pre-existing dementia and other neurological diseases.

Variables and instruments

Sociodemographic characteristics such as age, gender, living status, job status, and level of education were investigated to outline a preliminary profile of the sample. Alcohol and substance use (tobacco, caffeine, cannabis, stimulants, depressors or NPS) were evaluated later through self-reporting techniques. In addition, all patients were assessed both at the admission (T0) and at discharge (T1) through several psychometric scales: PANSS (*Positive and Negative Symptoms Scale*), SCL-90 (*Symptom checklist 90*), YMRS (*Young Mania Rating Scale*), HAM-D (*Hamilton Depression Scale*), HAM-A (*Hamilton Anxiety Scale*), MOAS (*Overt Aggression Scale*), C-SSRS (*Columbia Suicide Severity Rating Scale*), in order to explore different psychopathological aspects or behavioural disorders.

Self-report

TLFB (*Timeline follow-back for psychoactive substances and alcohol*) was crucial to identify the main substances of abuse for each subject: a self-administered questionnaire was given to the sample, and included variables related to the use of alcohol and other drugs, aspects of personality, favourable attitudes toward use of cocaine and cannabis, for alcohol and ecstasy and also items which asked whether subjects had used these substances the weekend before admission.

Biochemical analysis

As a direct measure of recent use (previous 72 hours), a biochemical urine sample was collected from the patients at T0, stored at – 30°C, and subsequently analysed using HPLC technology, which represents a peculiarly versatile analytical platform.
Both for the TLFB and the urinalysis collection were carried out in an anonymous and confidential way. All participants received a detailed explanation of the design of the study, and written informed consent was systematically obtained from every subject, according to the Declaration of Helsinki. Ethics approval was granted by the *University of Hertfordshire Health and Human Sciences ECDA*, protocol no. aPHAEC1042(03); by the CEI Illes Balears, protocol no. IB 2561/15 PI; and by the *University G. d'Annunzio* of Chieti-Pescara, no. 7/09-04-2015. Data were securely stored and made accessible only to the research team members.

Results

The analysis of the data shows some interesting sociodemographic characteristics which could have a significant

impact on the following evaluations: males represent the vast majority of the sample, with a percentage of 67,3%, compared to females (32,7%); with regards to nationality of the subjects enrolled, Spanish is predominant (54,2%), followed by British (16,7%), Italian (6,3%) and others (Lebanon, Canada, France, Netherlands, Colombia, Germany, listed by frequency). Data concerning the level of education highlight an upper-intermediate grade: graduated, under-graduated and post-graduated represent the 56,3% of the population. The educational factor reflects the mean age of the tested population, which is around 33 years old: the majority of sample is represented by young and single (64,3%) workers or unemployed (51,1% and 46,7%, while a mere 2% were students) who often live with parents/partners (26,7%) or alone (17,8%).

Another crucial element in the global evaluation of the study sample concerns the presence of a positive previous psychiatric history: up to 80% of the subjects refers a known psychiatric diagnosis and/or an acute previous admission to psychiatric units.

In a preliminary analysis of self-reporting questionnaires, subjects who reported alcohol abuse were only 8,3%, compared to those who consider themselves non-abusers (91,7%); with regards to illicit substance use, a marked gap can be identified too: subjects who declare substance use were only 29,2%, while 70,8% did not admit illicit substance consumption (Fig. 1).

A more specific evaluation obtained by combining self-reported results and urinalysis showed that 3 males who referred alcohol consumption had no evidence in urine sample; likewise, only one female reported use of alcohol the weekend before but urinalysis of the patient were positive for desmetildiazepam and tramadol. Only one subject referred alcohol abuse in association with drugs (cannabis or cocaine) or binge-drinking disorder.

Regarding to substance abuse, this is a controversial issue since patients who declared substance use often presented a negative urinalysis or results did not meet the declared drug intake.

In detail, the most commonly declared substance was cannabis (5 subjects), alone or more often in association with cocaine (7 subjects).

Cocaine intake alone or associated with other psychoactives such as GHB, MDMA, speed, ketamine was less frequent (2 cases), while 13 patients admitted a polyabuse condition (three or more drug intaken simultaneously) based on the combined consumption of cannabis/cocaine/MDMA; cannabis/cocaine/heroin/BDZ; cannabis/NO/MDMA; cannabis/cocaine/LSD; cannabis/ketamine/cocaine/ecstasy/GHB.

Comparing urinalysis and self-reported declaration, concordant and discordant findings arose: 7 subjects admitting cannabis use (alone or in association with other drugs, mainly cocaine) showed positive urine testing for THCCOOH; similarly, 5 patients declaring cocaine use / alone or combined with cannabis/MDMA/heroin) presented BENZOILECGONINE in urine samples.

The concordance rate between self-reporting and urinalysis seems to decrease among polyabusers, because substances like ketamine, MDMA, GHB, heroin and ecstasy did not match in the urinalysis of the subjects enrolled; furthermore, 7 males who self-reported cannabis use alone or cannabis/cocaine association report positive urine for DESMETILDIAZEPAM and OXAZEPAM but no evidence of THCCOOH or BENZOILECGONINE.

Three subjects denied the use of psychotropics, drugs, or alcohol but their urinalysis showed DESMETILDIAZEPAM and CITALOPRAM positive results; on the contrary, 7 subjects that admited cannabis or cocaine occasional consumption presented negative urinalysis for drugs. Only one female who declared no illicit substance use report effectively negative urinalysis (Fig. 2).

Limitations

Several studies proved that the sensitivity of self-reporting could be increased when data are collected with clear instructions to respondents, combined with methods to im-

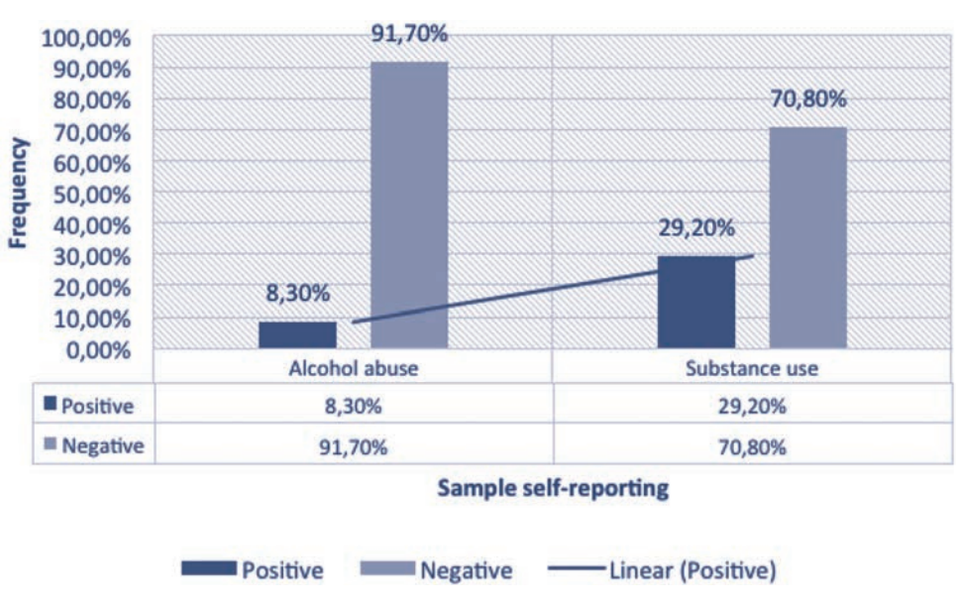

Figure 1.
Sample self-reporting.

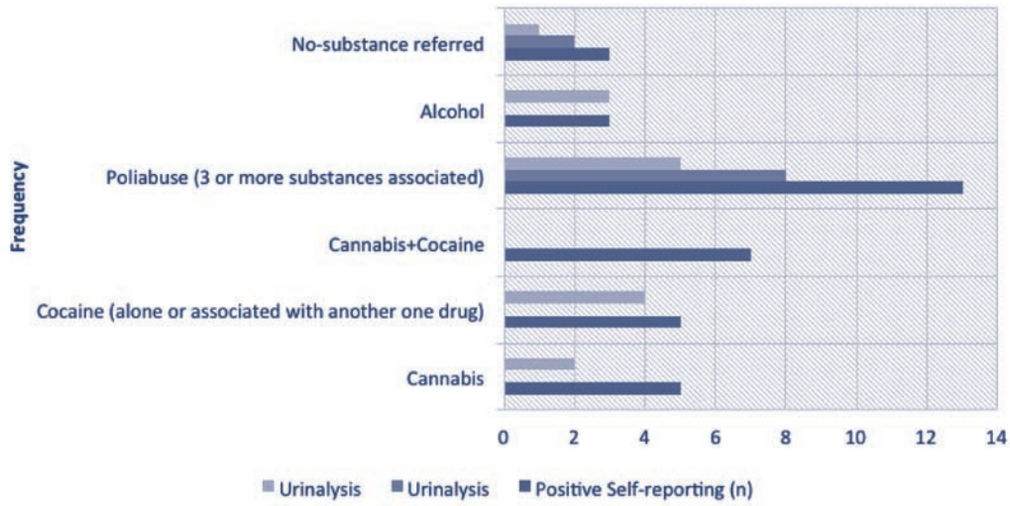

Figure 2.
Combined evaluation of self-reporting and urinalysis of the sample.

prove their motivation and to facilitate cognitive processing [26-28]. Nevertheless, the procedure presents several weak points: a well-known issue of self-reports is the uncertainty about their ability to accurately indicate what has really being measured. The validity of self-reported data is questionable, especially when the topic is sensitive or embarrassing: individuals may fear that disclosing illicit substance use could cause them legal problems or they may merely dread public opinion towards regrettable behaviours such as drug abuse. Therefore, even if confidentially is obviously guaranteed, fear of disapproval, punishment or embarrassment underpin the under-reporting phenomenon, which primarily affects the analytical reliability of self-reporting.
Although less common, the opposite phenomenon of over-reporting can also occur: subjects may over-report their consumption in order to get more medical prescriptions to avoid a withdrawal syndrome.
Evaluations based on gender revealed that males are more likely to under-report crack-cocaine use than females [29]; on the contrary, several studies focused on the validity of self-reporting across racial groups [30-32]. On the other hand, age differences in the validity of reporting abuse behaviours were initially noticed by Korotitsch & Nelson-Gray, R.O. (1999) [33], who showed that younger respondents provided more accurate self-reports than older ones, and later by [34] who found that younger respondents under-reported crack use but not marijuana use. Controlling for differences in base rates finally showed that drug offenders were more likely to under-report than non-drug offenders [35]. Despite certain differences in terms of gender, age, race or type of drug used have been highlighted, no statistical evidences regarding the basis of misreporting are still, to this day, revealed [36]. Even if self-reported data are usually cheaper to obtain, more practical and allow to gather more detailed information in comparison to biological markers, the above-mentioned issues related to risk of under- or over-reported drug use and limitations regarding psychosocial factors, unreliability of the subjects answers highlight that the self-report cannot be solely used for evaluation of substance use [37 38] and indicate the need for more effective and sensible diagnostic technique combining with this evaluation [39].
Currently, urinalysis is the favoured method for validating self-reported retrospective information to define drug use behaviours, becoming the gold standard to obtain a definitive diagnosis, to plan intervention, to monitor progress following treatment and also to provide an epidemiological instrument to provide patterns of drug abuse [22]. Unlike the self-reporting, urine screening is regarded as a more accurate measure of drug consumption because it is not subject to the potential biases related with the first one [40], but it also introduces limitations [41]: in addition to the higher cost of urine screen, its accuracy is crucially dependent on the sensitivity of the method, quantity of drug used or time since its use and the retention time of the substance [42-44].
Limitations in both survey methods form the basis of the evaluation regarding the level of concordance between self-reporting and urinalysis which are the aim of this study; several previous studies examined the causes of concordance or discordance among the two screening methods, underlying three types of factors: patient demographic characteristics, drug-use-related factors and treatment-related factors [30 42 45-47]. More recent studies showed that the level of concordance between self-report and urinalysis often reflected by kappa value which depends on many factors such as types of subjects, context of assessment and confidentiality of patient reports [47-49].
In conclusion, the need to combine self-reporting data and urinalysis in screening of drug abuse seems to be proven, but there is still doubt about the level of concordance between them [50].

Discussion

In light of published literature and above descripted results, a clear discordance between self-reporting and urine screening test emerges in the majority of the sample. Socio-demographical characteristics (sex, age, education and employment status) showed no significant evidence in determining discordance effects, even if in younger males who consumed cannabis [51] the concordance rate between the two methods is sensitively higher than among females and older patients. This may be mostly due to the different

kind of subjects evaluated, better fitting a 'clubber' profile and attending night-times social venues, more specifically night clubs [51-54]. Indeed, the recent growth of the clubbing phenomenon in the UK means that each week many young individuals, frequently using recreational drugs [55] such as NPS, attend late night dance venues, and each summer a relevant part of them seeks for holiday resorts abroad offering similar dance and social opportunities, increasing the dangers from consuming unexpected substances [56]. Clubbers are young, medium-high cultured and males in most cases, and they often consume illicit substances for recreational activities, to get used to the scene, or to ease sex [57 58]. This might explain why only a minority of the sample declares a habitual consumption of psychoactive substances [59], while in almost all cases is referred an occasional use of cannabis, alone or in association to GHB, MDMA, synthetic cannabinoids.

Moreover, discordance between reporting and biochemical analysis may depend on the detection window of urine testing, which is estimated around 72 hours for some drugs (cocaine and others), although cannabis can be detected until several weeks later in case of chronic use [60]. When no substance was identified, it was possible to hypothesise: (a) the presence of a psychoactive substance that could not be identified by common analytic methods; (b) the use of a substance with a short half-life; or (c) the consumption of a substance more than 72 hours before evaluation. The first scenario results particularly relevant in accordance with the extremely diverse characteristics of drugs, NPS in particular; indeed, one of the distinctive element of the NPS market is its ever-changing nature [61]. Compounds that are included into the narcotics legislation often decline/disappear from the market (with the exception of a few compounds) and new substances are introduced as their replacements. Therefore, the lack of knowledge about the whole composition of this substances could invalidate the conventional urine screening methods, often posing the question of revalidation; not least in terms of the chemical and metabolic structure, NPS cause quite a few diagnostic issues: from a chemical point of view, some NPS reflect simple modifications of controlled substances by changing the structure of known psychoactive substances or alternatively, substances with entirely different chemical structures are created. However, classic NPS subjected to legal control are immediately replaced by new uncontrolled derivatives and structural isomers of controlled substances frequently appear. Furthermore, analysing urine samples, possible metabolisation of the parent analytes should generally be considered and while synthetic cannabinoids show extensive metabolism to the point where most of the time only metabolites are detectable in urine samples, cathinones are metabolized to a far lesser degree; in the case of cathinones and piperazines, parent compounds are generally abundant in urine, for piperazines even in higher concentrations than their respective metabolites [62].

Another issue that should be taken into account is the fact that some of the parent compounds may be metabolites of other substances such as ephedrine and norephedrine can be formed by either metabolic reduction of methcathinone and cathinone, respectively, or oxidative metabolisation of methamphetamine and amphetamine, respectively. Taken into account these considerations, the high level of discrepancies still need to be explained. Several factors could contribute to this gap: the fear of social judgement often seems to be related with an under-report of substances morally stigmatised like heroin, LSD, MDMA, GHB or alcohol while widely-consumed drugs (cannabis at first and cocaine, too) are self-reported often associated with a positive urinalisys for THCCOOH (related with cannabis) or BENZOILECGONINE (cocaine urinary metabolite). Another arising element is the underestimation of BDZ as illicit substances: patients under-reported or totally denied BDZ consumption, but related urinalysis result positive for DESMETILDIAZEPAN or OXAZEPAM in the same subjects; the reasons behind this type of discordance could depend on the lack of knowledge about this substance itself: BDZ are often consumed in association with cannabis, probably to obtain a relaxing effect and it is not seen as a drug per se, but as a medication (or medicine).

However, patients are not always liars. Indeed, in some cases they are not aware of substances that they are consuming, but they totally trust the dealers and refer what they think they are consuming. Here the controversial subject of counterfeiting substances comes into play: in order to reduce the costs of street drugs production and to attract an even increasing population, the drug marketing developed metabolites structurally similar to the most common substances of abuse, but even more harmful and hard to identify through the main screening tests. This is the case for illicit fentanyl (fentanyl-contaminated heroin or FCH), for whom the lower price and potency make it frequently used as adulterant in street heroin, cocaine, and methamphetamine, or as heroin substitutes sold to unaware users with a high risk of overdoses. Fentanyl and its analogues have also been identified in counterfeit medicinal products, such as oxycodone, hydrocodone, and alprazolam tablets, or as components of speedball mixtures together with cocaine or other stimulants [63-65]. NPS also fit that description since they can be brought quickly to market, and since they are technically not illegal, they are often promoted as 'legal highs'. Many NPS products arrive at specialty shops and can be sold with little to no legal restraints in communities where authorities may be oblivious to their availability (*United Nations Office on Drugs and Crime*). A further example of counterfeit drug produced to stretch product cheaply is Fenethylline [66], also known as amphetaminoethyltheophylline and amfetyline, a combination of amphetamine and theophylline, which behaves as a prodrug to both of the aforementioned drugs. It is also marketed as psychostimulant under the brand names Captagon, Biocapton, and Fitton [67]. Consequently, all this evolving drug market represents a great and grave defect to the sample evaluation, mainly highlighted in the urine screening test: none of the subjects tested reported use of combinated drugs (that they are not aware) and they are not revealed in urinalysis.

In other cases, substances self-reported are not reflected in urinalysis results, which appear negative: this may due to subjects, who are not accurate in describing time and frequence taking or to misdelivery and processing mistakes of urine sample [36 68].

In conclusion, according to the findings mentioned above, it is clear that there is no certainty regarding all discordance causes between self-reporting and urinalysis but further research that target the optimization of assessment procedures combined with a more careful simultaneous evaluation of them could well allow a decrease in the discrepancy-phenomenon.

Conflict of interests

The authors declare no conflict of interest.

References

1 Bouchery EE, Harwood HJ, Sacks JJ, et al. *Economic costs of excessive alcohol consumption in the U.S. 2006*. Am J Prev Med 2011;41:516-24.

2 Kessler RC, Aguilar-Gaxiola S, Alonso J, et al. *The global burden of mental disorders: an update from the WHO World Mental Health (WMH) surveys.* Epidemiol Psichiatr Soc 2009;18:23-33.

3 Grant BF, Goldstein RB, Chou SP, et al. *Sociodemographic and psychopathologic predictors of first incidence of DSM-IV substance use, mood and anxiety disorders: results from the Wave 2 National Epidemiologic Survey on Alcohol and Related Conditions.* Mol Psychiatry 2009;14:1051-66.

4 Corbacho A, Rivera M, Trujillo F, et al. *A perspective from drug user organisations on "ECDC and EMCDDA guidance: prevention and control of infectious diseases among people who inject drugs".* BMC Infect Dis 2014;14(Suppl 6):S10.

5 Best D, Man LH, Gossop M, et al. *Drug users' experiences of witnessing overdoses: what do they know and what do they need to know?* Drug Alcohol Rev 2000;19:407-12.

6 Best D, Rawaf S, Rowley J, et al. *Drinking and smoking as concurrent predictors of illicit drug use and positive drug attitudes in adolescents.* Drug Alcohol Depend 2000;60:319-21.

7 Corazza O, Assi S, Malekianragheb S, et al. *Monitoring novel psychoactive substances allegedly offered online for sale in Persian and Arabic languages.* Int J Drug Policy 2014;25:724-6.

8 Martinotti G, Lupi M, Carlucci L, et al. *Novel psychoactive substances: use and knowledge among adolescents and young adults in urban and rural areas.* Hum Psychopharmacol 2015;30:295-301.

9 Santacroce R, Ruiz Bennasar C, Sancho Jaraiz JR, et al. *A matter of life and death: substance-caused and substance-related fatalities in Ibiza in 2015.* Hum Psychopharmacol 2017;32.

10 Schifano F, Leoni M, Martinotti G, et al. *Importance of cyberspace for the assessment of the drug abuse market: preliminary results from the Psychonaut 2002 project.* Cyberpsychol Behav 2003;6:405-10.

11 Schifano F, Deluca P, Agosti L, et al. *New trends in the cyber and street market of recreational drugs? The case of 2C-T-7 ("Blue Mystic").* J Psychopharmacol 2005;19:675-9.

12 Martinotti G, Corazza O, Achab S, et al. *Novel psychoactive substances and behavioral addictions.* Biomed Res Int 2014;2014:534523.

13 Martinotti G, Lupi M, Acciavatti T, et al. *Novel psychoactive substances in young adults with and without psychiatric comorbidities.* Biomed Res Int 2014;2014:815424.

14 Martinotti G, Orsolini L, Fornaro M, et al. *Aripiprazole for relapse prevention and craving in alcohol use disorder: current evidence and future perspectives.* Expert Opin Investig Drugs 2016;25:719-28.

15 Simonato P, Corazza O, Santonastaso P, et al. *Novel psychoactive substances as a novel challenge for health professionals: results from an Italian survey.* Hum Psychopharmacol 2013;28:324-31.

16 Kelly D, Hughes K, Bellis MA. *Work hard, party harder: drug use and sexual behaviour in young British casual workers in Ibiza, Spain.* Int J Environ Res Public Health 2014;11:10051-61.

17 Kelly BC, Wells BE, Pawson M, et al. *Combinations of prescription drug misuse and illicit drugs among young adults.* Addict Behav 2014;39:941-4.

18 Bellis MA, Hughes K, Bennett A, et al. *The role of an international nightlife resort in the proliferation of recreational drugs.* Addiction 2003;98:1713-21.

19 Bellis MA, Hughes K, Calafat A, et al. *Relative contributions of holiday location and nationality to changes in recreational drug taking behaviour: a natural experiment in the Balearic Islands.* Eur Addict Res 2009;15:78-86.

20 Bellis M, Hughes K, Thomson R, et al. *Sexual behaviour of young people in international tourist resorts*. Sex Transm Infect 2004;80:43-7.

21 Kelly BC, Rendina HJ, Vuolo M, et al. *Influences of motivational contexts on prescription drug misuse and related drug problems.* J Subst Abuse Treat 2015;48:49-55.

22 Simpson D, Greenwood J, Jarvie DR, et al. *Experience of a laboratory service for drug screening in urine.* Scott Med J 1993;38:20-6.

23 Simpson D, Jarvie DR, Moore FM. *Measurement of creatinine in urine screening for drugs of abuse.* Clin Chem 1993;39:698-9.

24 Allen KR. *Screening for drugs of abuse: which matrix, oral fluid or urine?* Ann Clin Biochem 2011;48:531-41.

25 Jain R. *Self-reported drug use and urinalysis results.* Indian J Physiol Pharmacol 2004;48:101-5.

26 Del Boca FK, Noll JA. *Truth or consequences: the validity of self-report data in health services research on addictions*. Addiction 2000;95(Suppl 3):S347-60.

27 Hall W, Babor TF. *Cannabis use and public health: assessing the burden.* Addiction 2000;95:485-90.

28 Babor TF. *Past as prologue: the future of addiction studies*. Addiction 2000;95:7-10.

29 Lu NT, Taylor BG, Riley KJ. *The validity of adult arrestee self-reports of crack cocaine use.* Am J Drug Alcohol Abuse 2001;27:399-419.

30 Magura S, Goldsmith D, Casriel C, et al. *The validity of methadone clients' self-reported drug use*. Int J Addict 1987;22:727-49.

31 Magura S, Freeman RC, Siddiqi Q, et al. *The validity of hair analysis for detecting cocaine and heroin use among addicts.* Int J Addict 1992;27:51-69.

32 McGregor K, Makkai T. *Self-reported drug use: how prevalent is underreporting?* Trends and Issues in Crime and Criminal Justice 2003;260:1-6.

33 Korotitsch W J, Nelson-Gray RO. *An overview of self-monitoring research in assessment and treatment.* Psychological Assessmen 1999;11:415-25.

34 Hunter GM, Donoghoe MC, Stimson GV. *Crack use and injection on the increase among injecting drug users in London.* Addiction 1995;90:1397-400.

35 Gray TA, Wish ED. *Substance use and need for treatment among arrestees (SANTA) in Maryland*. College Park, MD: Center for Substance Abuse Research 1997.

36 Rosay AB, Najaka SS, Herz DC. *Differences in the validity of self-reported drug use across five factors: Gender, Race, Age, Type of Drug and Offense seriousness*. J Quant Criminol 2007;41-58.

37 Zaldívar Basurto F, García Montes JM, Flores Cubos P, et al. *Validity of the self-report on drug use by university stu-*

dents: correspondence between self-reported use and use detected in urine. Psicothema 2009;21:213-9.
38 Ashrafi S, Aminisani N, Soltani S, et al. *The validity of self-reported drug use with urine test: results from the pilot phase of Azar cohort study.* Health Promot Perspect 2018;8:225-9.
39 Gryczynski J, Schwartz RP, Mitchell SG, et al. *Hair drug testing results and self-reported drug use among primary care patients with moderate-risk illicit drug use.* Drug Alcohol Depend 2014;(141):44-50.
40 Yao P, Ciesla JR, Mazurek KD, et al. *Peer relations scale for adolescents treated for substance use disorder: a factor analytic presentation.* Subst Abuse Treat Prev Policy 2012;(127):29.
41 Reschly-Krasowski JM, Krasowski MD. *A difficult challenge for the clinical laboratory: accessing and interpreting manufacturer cross-reactivity data for immunoassays used in urine drug testing.* Acad Pathol 2018;5:2374289518811797.
42 Digiusto E, Seres V, Bibby A, et al. *Concordance between urinalysis results and self-reported drug use by applicants for methadone maintenance in Australia.* Addict Behav 1996;21:319-29.
43 Kilpatrick B, Howlett M, Sedgwick P, et al. *Drug use, self report and urinalysis.* Drug Alcohol Depend 2000;58:111-6.
44 Kilpatrick DG, Acierno R, Saunders B, et al. *Risk factors for adolescent substance abuse and dependence: data from a national sample.* J Consult Clin Psychol 2000;68:19-30.
45 Wish ED, Hoffman JA, Nemes S. *The validity of self-reports of drug use at treatment admission and at followup: comparisons with urinalysis and hair assays.* NIDA Res Monogr 1997;167:200-26.
46 Wilcox CE, Bogenschutz MP, Nakazawa M, et al. *Concordance between self-report and urine drug screen data in adolescent opioid dependent clinical trial participants.* Addict Behav 2013;38:2568-74.
47 Denis C, Fatséas M, Beltran V, et al. *Validity of the self-reported drug use section of the Addiction Severity Index and associated factors used under naturalistic conditions*. Subst Use Misuse 2012;47:356-63.
48 Chermack ST, Stoltenberg SF, Fuller BE, et al. *Gender differences in the development of substance-related problems: the impact of family history of alcoholism, family history of violence and childhood conduct problems*. J Stud Alcohol 2000;61:845-52.
49 Chermack ST, Roll J, Reilly M, et al. *Comparison of patient self-reports and urinalysis results obtained under naturalistic methadone treatment conditions.* Drug Alcohol Depend 2000;59:43-9.
50 Li L, Liang LJ, Lin C, et al. *Comparison between urinalysis results and self-reported heroin use among patients undergoing methadone maintenance treatment in China.* Subst Use Misuse 2017;52:1307-14.
51 Sherlock K, Wolff K, Hay AW, et al. *Analysis of illicit ecstasy tablets: implications for clinical management in the accident and emergency department.* J Accid Emerg Med 1999;16:194-7.
52 Forsyth AJ, Barnard M, McKeganey NP. *Musical preference as an indicator of adolescent drug use.* Addiction 1997;92:1317-25.
53 Bellis MA, Hale G, Bennett A, et al. *Ibiza uncovered: changes in substance use and sexual behaviour amongst young people visiting an international night-life resort.* Int J Drug Policy 2000;11:235-44.
54 Calafat A, Cajal B, Juan M, et al. *The influence of personal networks on the use and abuse of alcohol and drugs.* Adicciones 2010;22:147-54.
55 Calafat A, Hughes K, Blay N, et al. *Sexual harassment among young tourists visiting Mediterranean resorts.* Arch Sex Behav 2013;42:603-13.
56 Bean PT, Wilkinson CK. *Drug taking, crime and the illicit supply system.* Br J Addict 1988;83:533-9.
57 Vento AE, Martinotti G, Cinosi E, et al. *Substance use in the club scene of Rome: a pilot study.* Biomed Res Int 2014;2014:617546.
58 Simonato P, Bersani FS, Santacroce R, et al. *Can mobile phone technology support a rapid sharing of information on novel psychoactive substances among health and other professionals internationally?* Hum Psychopharmacol 2017;32.
59 Schifano F, Ricciardi A, Corazza O, et al.; Gruppo di Ricerca "Psychonaut Web Mapping". *New drugs of abuse on the Web: the role of the Psychonaut Web Mapping Project.* Riv Psichiatr 2010;45:88-93.
60 Cone EJ. *New developments in biological measures of drug prevalence*. NIDA Res Monogr 167:108-29.
61 Cinosi E, Corazza O, Santacroce R, et al. *New drugs on the Internet: the case of Camfetamine.* Biomed Res Int 2014;2014:419026.
62 Ambach L, Redondo AH, König S, et al. *Detection and quantification of 56 new psychoactive substances in whole blood and urine by LC-MS/MS.* Bioanalysis 2015;7:1119-36.
63 Pergolizzi JV Jr, LeQuang JA, Taylor R Jr, et al.; NEMA Research Group. *Going beyond prescription pain relievers to understand the opioid epidemic: the role of illicit fentanyl, new psychoactive substances, and street heroin.* Postgrad Med 2018;130:1.
64 Pichini S, Busardò FP, Gregori A, et al. *Purity and adulterant analysis of some recent drug seizures in Italy.* Drug Test Ana 2017;9:485-90.
65 Pichini S, Busardo FP, Pacifici R, et al. *Editorial new psychoactive substances (nps), a new global issue: neuropharmacological, chemical and toxicological aspects.* Curr Neuropharmacol 2017;15:656-7.
66 Pichini S, Pacifici R, Marinelli E, et al. *European drug users at risk from illicit Fentanyls mix.* Front Pharmacol 2017;8:785.
67 Al-Imam A, Santacroce R, Roman-Urrestarazu A, et al. *Captagon: use and trade in the Middle East.* Hum Psychopharmacol 2017;32.
68 Kinlock TW, Gordon MS, Schwartz RP, et al. *A study of methadone maintenance for male prisoners.* Crim Justice Behav 2008;35:34-47.