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

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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 worldwide1-3. 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 Europe4. Frequently, fatalities are associated with injecting drugs and, in most cases, involve a combination of substances4-6. 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. In recent years, new issues of concern are represented by novel psychoac-
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 study- ing patterns of drug abuse/22-24. However, urine test should follow a primary assessment, using self-report measure- ment 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 il- licit 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 char- acteristics such as low cost, flexibility, adaptability, effi- ciency, portability, the possibility to collect data through a variety of technologies (telephone, computer, video) and also the possibility of collecting an abundance of informa- tion 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 dis- cordance between the two assessment methods.

Materials and methods

Study subjects and recruitment

48 subjects were enrolled between June 2015 and Sep- tember 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 in- formed 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 crite- ria included: current presence of delirium tremens or halluci- nosis at the moment of clinical interview (possible re-eval- uation 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 inves- tigated to outline a preliminary profile of the sample. Alco- hol and substance use (tobacco, caffeine, cannabis, stim- ulants, depressors or NPS) were evaluated later through self-reporting techniques. In addition, all patients were as- sessed 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 (Hamil- ton Depression Scale), HAM-A (Hamilton Anxiety Scale), MOAS (Overt Aggression Scale), C-SSRS (Columbia Suic- ide 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 question- naire was given to the sample, and included variables re- lated to the use of alcohol and other drugs, aspects of per- sonality, 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 Hert- fordshire 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 sociode- mographic 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 reported 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 admitted 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-
prove their motivation and to facilitate cognitive processing 26-28. Nevertheless, the procedure presents several weaknesses: a well-known issue of self-reports is the uncertainty about their ability to accurately indicate what has really been 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 confidentiality 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 described 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 [53] 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 [58]. 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 (cannabis 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 metabolisation 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 metabolism 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-used substances (cannabis at first and cocaine, too) are self-reported often associated with a positive urinalysis for THCCOOH (related with cannabis) or BENZOIECOG- NINE (cannabis 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 in the urine screening test: none of the subjects tested reported use of combinated drugs (that they are not aware) and grave defect to the sample evaluation, mainly high levels of contaminants and the underestimation of BDZ as illicit substances: patients are self-reported often associated with a positive urinalysis result positive for THCCOOH (related with cannabis) or BENZOIECOGNINE (cannabis 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).
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.

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