Research Article

Measuring the harms of psychotropic substance use and poly-use in the nightlife scene: a pilot application of poly-drug use indicators on Italian data collected within the ALAMA study

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Poly-drug use is becoming increasingly common, in particular in young user groups. Classical single drug use indicators are not adequate to measure the combined possible harms of such patterns of use, while more complex indicators can summarize the total effects. One set of such indicators is used in this paper, based on individual frequency of use data and expert evaluations of single substance harms of various types. The indicators are applied to a set of Italian data relating to subjects who use psychotropic substances in nightlife, collected as part of the Eranid-Alama project. It is shown that the use of these poly-drug use indicators can be useful for characterizing high-risk subgroups of users and for studying associations between drug use and concomitant variables. In general, these indicators are also adequate for comparisons between different user groups and populations in various countries.

An original point addressed in this study for the first time is the classification of new psychotropic substances (NPS) of interest for the survey, in collaboration with specific experts.

Introduction

Poly-drug use, i.e. the use of multiple substances, is becoming increasingly widespread among drug users, representing a serious challenge both for researchers and drug use prevention and treatment

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operators. As defined by the WHO, this broad concept encompasses the use of more than one drug or type of drug by an individual — consumed at the same time or sequentially.

Over the past decades, epidemiological data from surveys conducted among the general population have improved our understanding of the diversity of drug use patterns and related problems, supporting the development of improved frameworks for designing and evaluating drug-related interventions, and for better targeting drug user populations with sometimes very different problems and needs.

In contrast, the understanding of multiple substance use in specific sub-populations has been more limited. This lack of knowledge has become particularly important in recent years, as increasing prevalence levels of drug use (e.g. alcohol, cannabis and cocaine) have been observed in new and very different populations of drug users, and as an increasing range of available substances, particularly the rapid emergence, and modification, of New Psychoactive Substances (NPS), has resulted in additional drug combination possibilities, always in change. In such a context, the limitations of substance-specific approaches to understanding drug use patterns, trajectories and related harms have become increasingly apparent.

While it is well known that poly-drug use can lead to multiple harms, ranging from adverse health consequences to social problems, studying it remains a challenge, both at the conceptual and at the practical levels. Conceptually, poly-drug use encompasses not only wide variation in the patterns of use (from the occasional use of alcohol and cannabis to the frequent combination of less known, or even new, substances), but also in user populations. Particularly referring to the latter, it is widely known that the evolving nightlife scene in western countries is associated with relatively high rates of substance use and that drug markets rapidly change, in particular concerning new psychoactive substances. Understanding young adults' patterns of use and poly-use, as well as health and social consequences, is crucial for planning preventive policies and reducing harms. In this light, it seems of utmost importance to investigate the complex patterns of poly-drug consumption, as well as to take account of both the potential level of harm for the individual and for the others, in the specific population of participants in the nightlife scene.

To overcome the challenges linked to the study and measurement of poly-drug use, specific indicators that are capable of measuring the individual levels of harm following drug use, and, in particular, poly-drug use, have previously been proposed and applied to various drug user populations by e.g. Fabi et al. (2014) and Mammone et al. (2014). These indicators are based on individual drug use

frequency data and expert rankings of harms related to various "classical" substances, proposed by van Amsterdam et al. (2010) and Nutt et al. (2010). They allow the estimation of risk profiles for selected groups of individuals and comparisons, both over time and between populations. Recent advances regarding the ranking of drug use harms, proposed in the joint paper by van Amsterdam and Nutt (van Amsterdam et al. 2015), allow a refinement of the indicators, clearly separating the harm effects on self and on others following drug use. The new indicators have been applied to the Italian ESPAD data[1], where interesting correlations between the values of the indicators and variables describing status and relationship with parents have been found, potentially useful for designing preventive policies (Colasante et al., 2019 and Fabi et al., 2023).

An account of the application of the poly-drug use indicators, based on scores of harm to self and to others related to classic substances, such as heroin, cocaine, alcohol..., to various subpopulations is provided in Fabi and Rossi (2023). However, new substances introduced into the black market do not have harm scores yet. This mainly depends on the speed of introduction of these substances and the quick changes in them. If one also wants to consider the harms associated with such new substances, it is necessary, based on those whose use is to be detected in specific surveys and, following the method reported in van Amsterdam et al. (2015), classify these substances with regards to the harm scores and then use poly-drug use indicators.

The purpose of this study is to show how to use van Amsterdam and Nutt's approach to assess the scores of new substances, to be detected in any specific survey, and the application in assessing indicators of poly-drug use in the survey conducted in the project Eranid-Alama[2].

This report can suggest how to proceed for the detection of new substance use in any application of interest and measure health and social consequenses, even of poly-drug use on the basis of the poly-drug use indicators.

This paper shows, as a simple example, the application of this methodology to the population of drug addicts in a subpopulation of partygoers. For this purpose, we use data from the ALAMA project database. This dataset is described in detail in the next section. The preliminary analyses of the data show that most nightlife substance users are poly-substance users, with associated health and social consequences that can be measured by the indicators.

In the next sections, some exploratory analyses of the descriptive variables of the subjects who participated in the online survey are reported, the poly-drug use indicators and the new scores for the

NPS are described and the indicators are then applied to the survey data, with focus on the link between subject variables and the levels of use and poly-use of psychotropic substances.

A final section contains conclusive considerations and suggestions for improving scores, indicators and, above all, the approach to new online surveys.

Data and methods

The ALAMA study, financed by the European Research Area Network on Illicit Drugs (ERANID[3]) has investigated the drug use pathways in the nightlife scene and its consequences in five European countries (Belgium, Italy, Sweden, the Netherlands, United Kingdom) with the specific aim of identifying substance use profiles of young Europeans attending nightclubs, festivals and parties/raves via transversal and longitudinal online surveys, as suggested by the European Monitoring Centre for Drug and Drug Addiction (EMCDDA)[4] "*Online self-report targeted surveys can provide an opportunity to follow up respondents to in situ surveys, again offering new and exciting ways to improve monitoring*".

The transversal and longitudinal online data collection captures, in particular, detailed information on demographics, nightlife engagement and drug use. The transversal survey is designed to assess retrospective information (lifetime and last 12 months).

Baseline data was collected in the period May 2017-November 2017. Young adults were recruited online (mainly via social media) and at festivals and clubs. Inclusion criteria: residence in Belgium, Italy, Sweden, the Netherlands, or the UK; 18-34 years of age; attendance of at least 6 dance/electronic music events in the last 12 months. In the period of data acquisition, participants filled the baseline online questionnaire.

The analyses in this paper are based on the Italian dataset, with a focus on poly-drug use indicators, including also New Psychometric Substances, to fully show the entire new methodology.

Exploratory ALAMA analyses: subjects and substances

The Italian respondents were in total 1996 and, after exclusion of ineligible subjects and subjects with incomplete questionnaires, the following analyses will be based on a sample size of 1548 respondents. The preliminary explorative analyses show that the subjects who participated in the survey in Italy are 79% male, 20.6% female and 0.4% other. The age distribution is shown in Figure 1.

Given that data were only collected on subjects from a specific population between the ages of 18 and 34, it is not relevant to compare the age distribution with other surveys with different age limits (ESPAD survey 15-19) and General Population Survey (15-64).

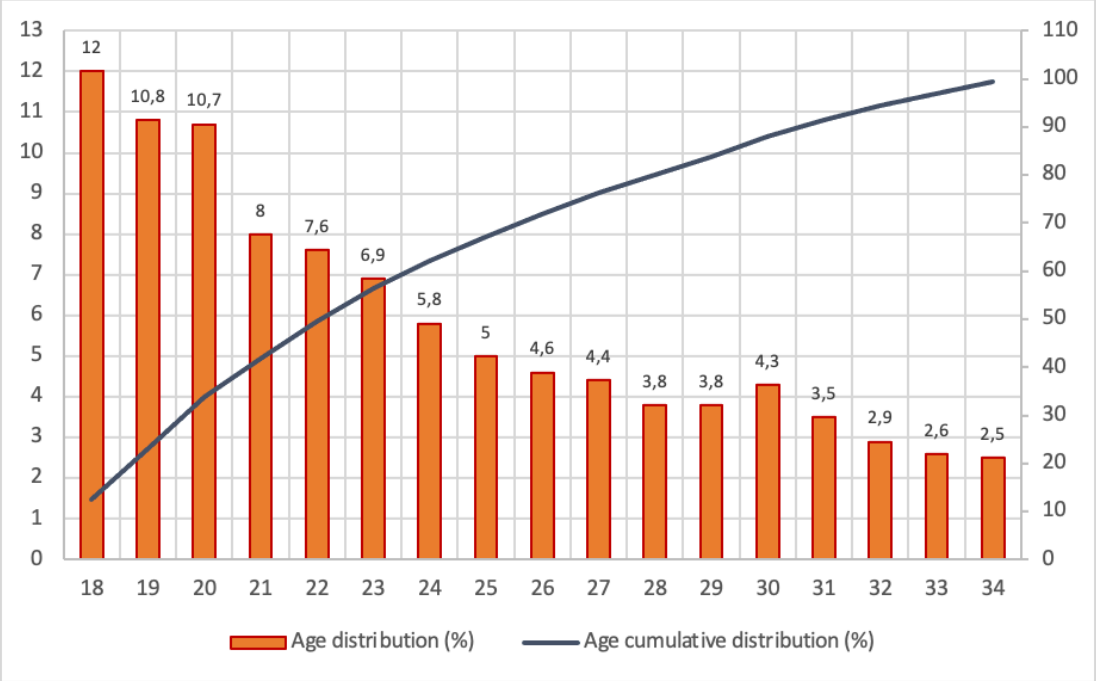

Figure 1. Age distribution of the Italian ALAMA subjects.

The modal value is 18, the median is 22 years, i.e. half of the subjects do not exceed 22 years of age, the first quartile is between 19 and 20 years and the third quartile between 26 and 27 years; it is thus a quite young sample population with mean=23.7 and standard deviation=4.7 (CV=20%).

The distribution of the variable "Civil Status" is reported in Table 1 and is composed mostly by singles as to be expected, given the age distribution.

The distribution of the variable "Educational level" is shown in Figure 2. This variable is not very dispersed. If we assign order values to the four levels and calculate the mean and the standard deviation we have mean=3.08, standard deviation=0.77 (CV=25%). The distribution of the variable "Occupation" (Figure 3) shows that there are rather few "NEE" (Not Employed or in Education) subjects.

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Civil Status	Percentage
Single	53.7
Married or in a civil partnership	1.2
Divorced or separated	0.3
In a relationship, not living with partner	35.0
In a relationship and living with partner	9.5
Widow(er)	0.3
Total	100.0

Table 1. Distribution of the variable "Civil Status".

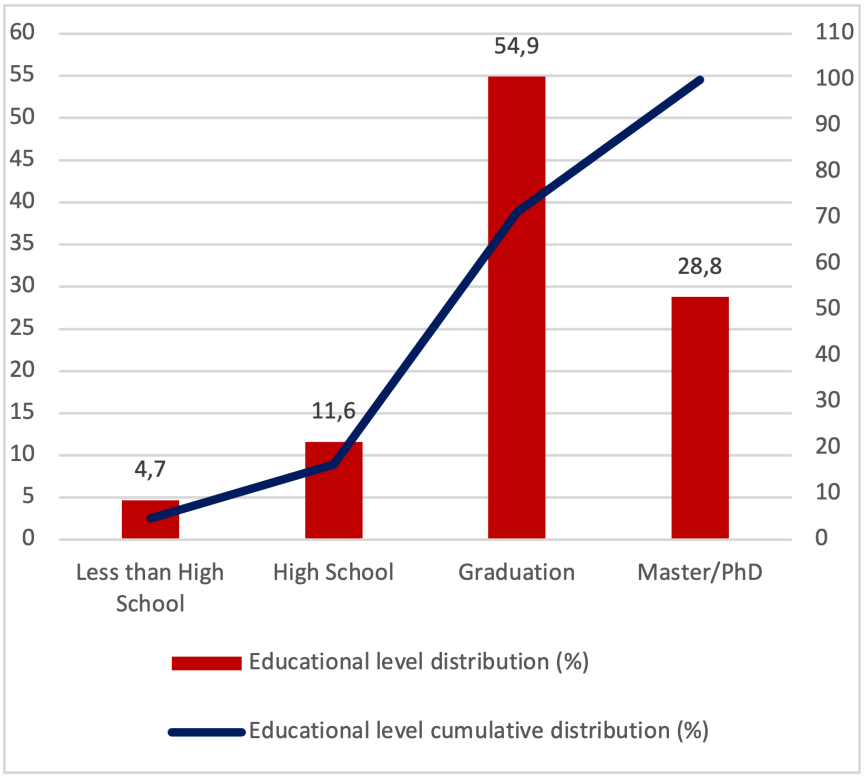

Figure 2. Distribution (%) of the variable "Educational level".

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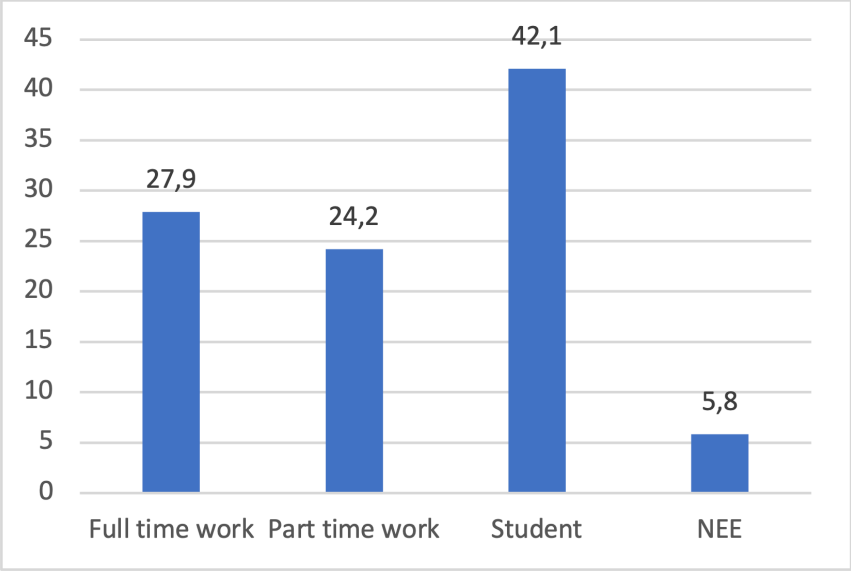

Figure 3. Distribution (%) of the variable "occupation".

A variable that shows more heterogeneity is "Residence" (Figure 4). Apart from the approximately 9 % who live in rural areas, the other subjects are about equally divided between large and small cities. The variable that describes the frequency of musical events attended during the last 12 months is shown in Figure 5.

In Figure 6, respondents' lifetime and last 12 months attendance to different kinds of events is shown. It is interesting to note the different degrees of change of the proportions in different categories.

The analyses show that the sample is rather homogeneous regarding demographic and social variables and the distribution of "Occupation" and "Educational level" suggest a sample different from typical "problematic use" subjects who usually have lower educational levels and even lower levels of employment, as is well known from the huge number of studies on problematic drug use.

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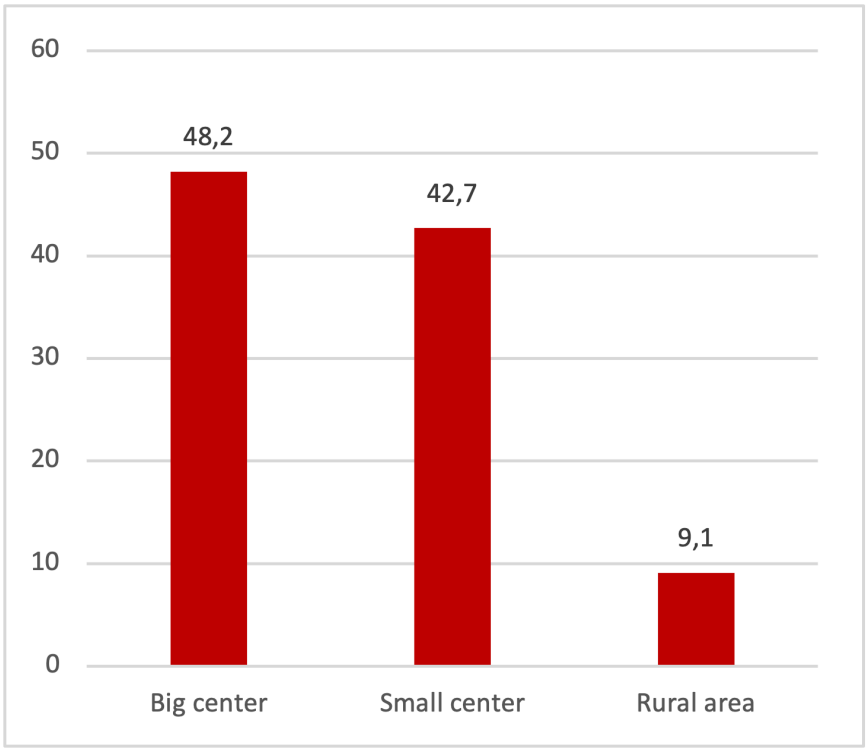

Figure 4. Distribution (%) of the variable "Residence".

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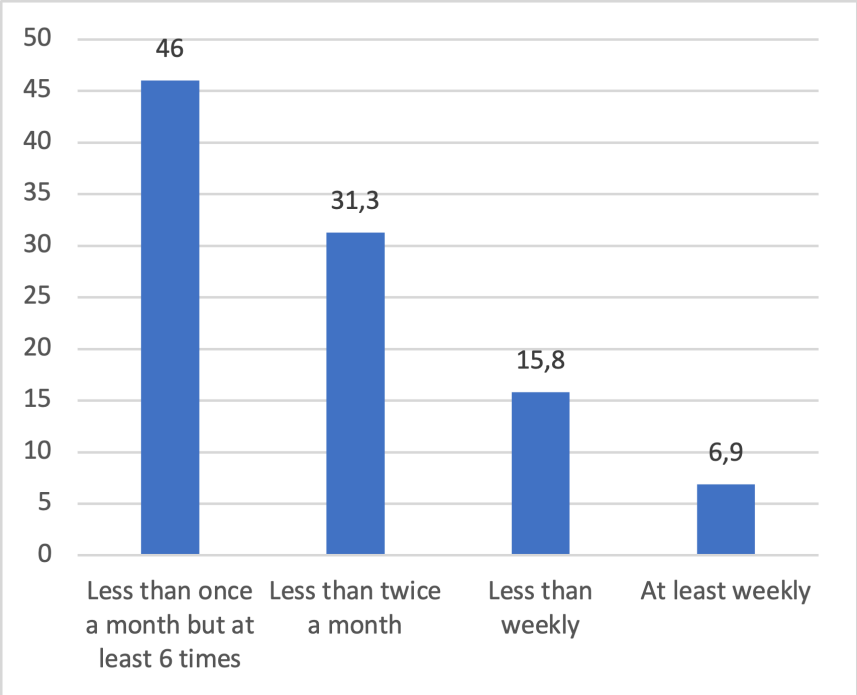

Figure 5. Distribution (%) of the number of musical events attended during the last 12 months.

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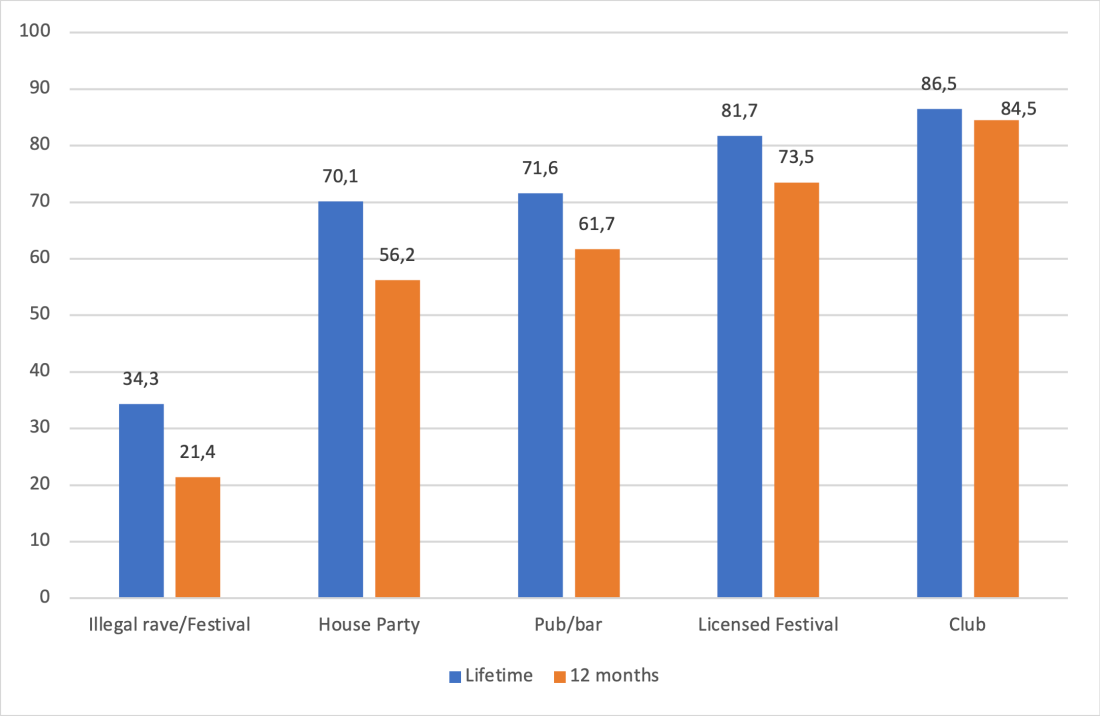

Figure 6. Nightlife venues or events attended.

Figures 7a and 7b show the distribution (%, left axis) and the empirical cumulative distribution (right axis) of the (self-declared) number of substances used by the subjects (6% declare 0 substances lifetime and 10% in the last 12 months).

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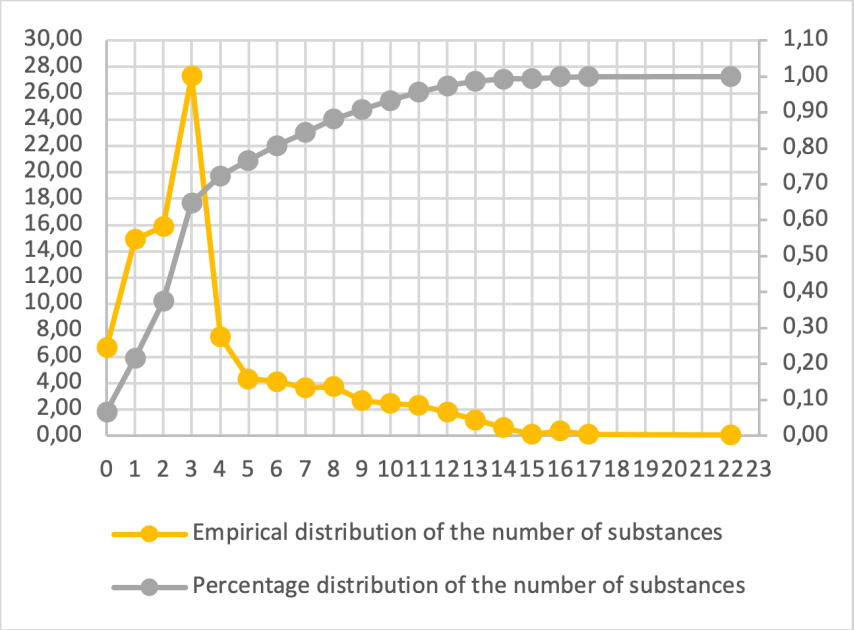

Figure 7a. Distribution (%) of the number of substances used in lifetime as declared (sample size 1548).

Modal value: 3

Average: 3.93

Median: 2.50

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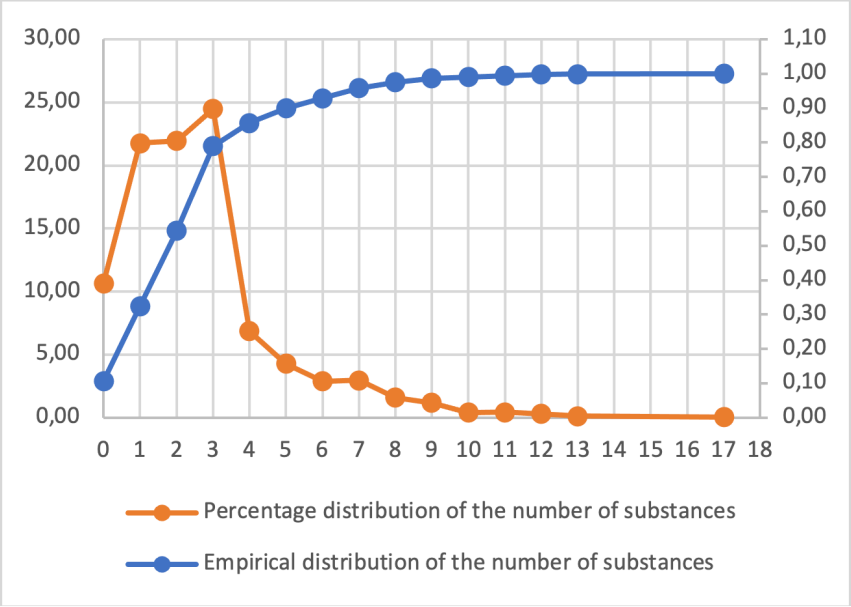

Figure 7b. Distribution (%) of the number of substances used in the last 12 months as declared sample size 1548).

Modal value: 3

Average: 2.65

Median: 1.50

Table 2 shows the frequency of use of each investigated substance, lifetime and in the last 12 months. It should be added that the category "Other substance" was present in the survey, but very few subjects reported anything not in the main list. The most frequent answers (at least 5 subjects) among this category were Opium (20 subjects), Salvia Divinorum (12 subjects), Crack (7 subjects) and Mescalin (5 subjects). It is clear that the most used substance is alcohol, followed by cannabis, tobacco, ecstasy and cocaine. NPS are shown in red. As a measure of persistence of use, Delta % has been calculated for each substance, being defined as the percentage of lifetime users who have not used the substance during the last 12 months (high values indicate non-persistence).

The sample size of users here and in the following analyses is 809, as some substance incomplete questionnaires have been excluded; as well as data relating to those who declare that they have not used any substance.

Taking into account a statement by EMCDDA "*Surveys in nightlife settings tend to focus more broadly on 'substance use', rather than simply on (illicit) 'drug use', reflecting the complexity of contemporary patterns of non-medical use of psychoactive substances"*, it is useful to consider the illegal and legal substances separately.

The average number of substances used by users lifetime is 5.5 per person, including alcohol and tobacco in addition to illegal classical substances and NPS (NPS=0.7 per person). The average number of substances used in the last 12 months is 4 per person, including alcohol and tobacco in addition to illegal classical substances and NPS (NPS=0.26 per person).

If legal substances (alcohol and tobacco) are excluded, the average numbers of substances used lifetime per person are: 4.5 substances excluding Alcohol, 4.6 excluding Tobacco and 3.6 excluding both (2.93 classical substances and 0.67 NPS). If legal substances (alcohol and tobacco) are excluded, the average numbers of substances used in the last 12 months per person are: 3.1 substances excluding Alcohol, 3.2 excluding Tobacco and 2.2 excluding both (1.94 classical substances and 0.26 NPS).

Substance	Percentage of use lifetime	Percentage of use in the last 12 months	Delta %
Alcohol	97.2	96.3	0.9
Cannabis	98.8	95.7	3.1
Tobacco	88.6	83.7	5.5
Ecstasy	41.7	28.8	30.9
Cocaine	36.5	24.4	33.1
Ketamine	24.4	12.7	47.9
Amphetamine	24.4	12.6	48.3
Amyl / alkyl nitrates ('poppers')	23.5	8.3	64.7
LSD	20.8	8.0	61.5
MDA	17.7	8.0	54.8
Mushrooms	22.1	6.8	69.2
Synthetic Cannabinoids	9.6	4.3	55.2
Benzodiazepines	9.0	4.1	54.4
Prescription opiates	7.4	3.3	55.4
DMT	4.7	2.0	57.4
Nitrous oxide	6.1	1.6	73.8
Heroin	4.2	1.6	61.9
Synthetic Hallucinogens	3.9	0.9	76.9
GHB	2.0	0.5	75
Synthetic Dissociatives	1.4	0.5	64.3
Mephedrone	1.4	0.4	71.4
4-FA/4-FMP	0.2	0.1	50

Table 2. Frequency (%) of use of each substance (number of "yes" for each substance) among users lifetime and in the last 12 months (NPS in red).

How to assess the Harm-to-self and the Harm-to-others scores of new substances of interest for the current survey

To measure poly-substance use in the ALAMA data, using poly-drug use indicators, it was necessary to update the substance scores necessary for the calculation of poly-drug use and related harms

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indicators in order to include also some New Psychotropic Substances (NPS) considered in the questionnaire of the survey.

For this, an agreement was established with the Early Warning System experts in Italy, working at the Superior Institute of Health of the Ministry of Health, who worked to assess the NPS scores following the method reported in van Amsterdam et al. (2015). Specifically, the scores for overall harm to users and to others associated with NPSs were assessed using the multi-criteria analysis model used by van Amsterdam at al. (2015). Briefly, for each of the 16 harm criteria the most harmful drug/drug class was identified and given the maximum score, considering the consensus criteria, weights for both harm to users (cumulative weight of 53) and harm to others (cumulative weight of 47). Remaining drugs/drug classes were evaluated in relation to the most harmful drug. Harm scores given independently by the experts of the Italian EWS were discussed to obtain consensus on the final scores.

The complete set of scores, for classical substances as given in van Amsterdam et al. (2015) and to NPS, as evaluated by Italian EWS experts, is shown in Figure 8 and Table 3.

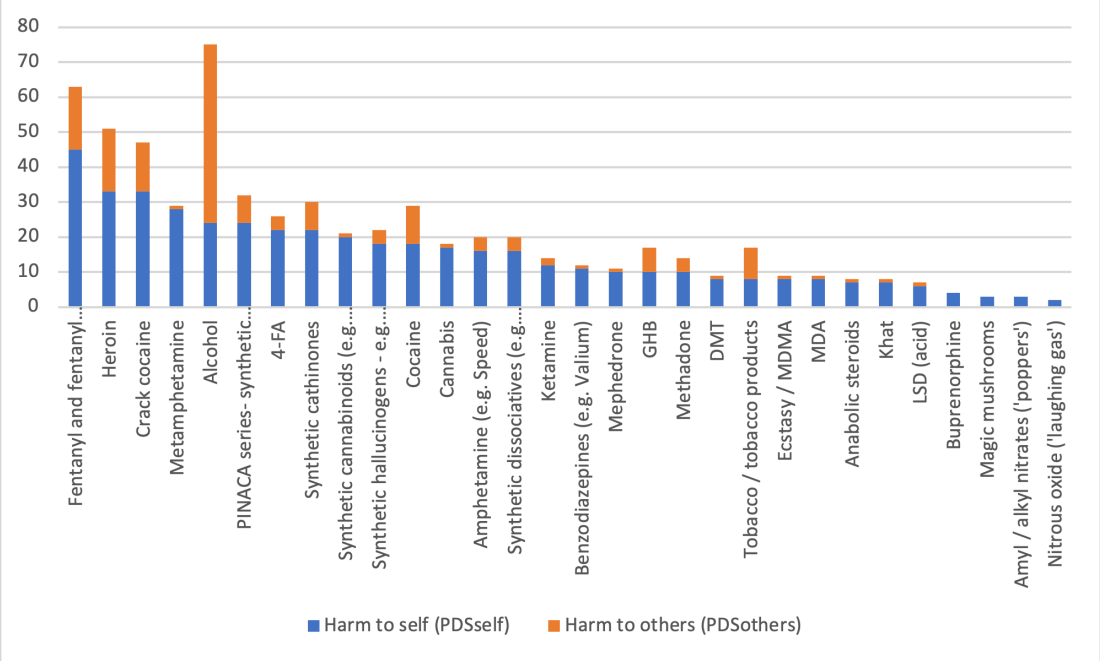

Figure 8. Harm to self and Harm to others scores related to "classical" and new substances.

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Substance	Harm to self (PDS^{self})	Harm to others (PDS^{others})
Fentanyl and fentanyl analogues - synthetic opioids	45	18
Heroin	33	18
Crack cocaine	33	14
Metamphetamine	28	1
Alcohol	24	51
PINACA series- synthetic cannabinoids	24	8
4-FA	22	4
Synthetic cathinones	22	8
Synthetic cannabinoids (e.g. 'Spice')	20	1
Synthetic hallucinogens - e.g. 2-CB. 25I-NBOMe	18	4
Cocaine	18	11
Cannabis	17	1
Amphetamine (e.g. Speed)	16	4
Synthetic dissociatives (e.g. methoxetamine)	16	4
Ketamine	12	2
Benzodiazepines (e.g. Valium)	11	1
Mephedrone	10	1
GHB	10	7
Methadone	10	4
DMT	8	1
Tobacco / tobacco products	8	9
Ecstasy / MDMA	8	1
MDA	8	1
Anabolic steroids	7	1
Khat	7	1
LSD (acid)	6	1
Buprenorphine	4	0
Magic mushrooms	3	0
Amyl / alkyl nitrates ('poppers')	3	0
Nitrous oxide ('laughing gas')	2	0

Table 3. Harm to self and Harm to others scores related to "classical" and new substances (NPS in red).

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Poly-drug use indicators applied to the Italian ALAMA data

The indicators used in this analysis are described in detail in Colasante et al. (2019) and in Fabi and Rossi (2023). Their main characteristics are only briefly described here, together with some details about the NPS-extended harm scores used in the analyses.

All indicators are calculated on individual data. The Frequency of Use (FUS) indicator is defined using weights describing the frequency of use of each substance, for a suitable time range: lifetime, 12 months, 30 days or specific time range, and summing the weights over all substances consumed by each subject in the period. The indicator thus estimates the total number of drug intakes during the studied period. The indicator can then be normalized by dividing by the maximum value of a single drug use frequency, yielding the normalized FUS indicator, denoted by F.

In addition to the FUS indicator, two further indicators, PDS^{self} and PDS^{others}, based respectively on the Harm to self and Harm to others scores, are obtained as the weigthed means of these harm scores, using normalized frequency of use as weights. The two indicators are normalized by dividing the scores of the individual substances by the maximum score of Table 3. As mentioned above, full details are available in Fabi and Rossi (2023), but it is of interest to mention that the highest scoring illegal substance, thus deemed most dangerous in the present ranking, that is used for normalization, is fentanyl, in van Amsterdam at al. (2015) was heroin.

Poly-drug use analyses and results

Table 4 shows the frequency of use scale used in the ALAMA survey (use during the last twelve months) and the corresponding base values for the FUS indicator and the normalized FUS (F) which are then applied for each substance and each user.

Answer on frequency of use (qualitative FUS)	FUS related to last 12 months base values	Normalized FUS (F) base values
Three times or less in the year	2	0.01
Every two or three months	5	0.02
Monthly	12	0.05
Fortnightly	26	0.1
Weekly	52	0.2
Three time a week or more	260	1

Table 4. ALAMA frequency of use, FUS base values and F indicator base values.

Figure 9 shows the distribution (%) of survey responses (excluding non-consumers, sample size 809) regarding the frequency of use in the last 12 months. The U-shape indicates that the questionnaire scale is too rough, especially on high frequency values. For instance, the lack of the response category "at least once every day", used regularly in similar surveys, prevents the identification of the most intense users, which would be useful to plan intervention, in particular secondary and indicative prevention programs.

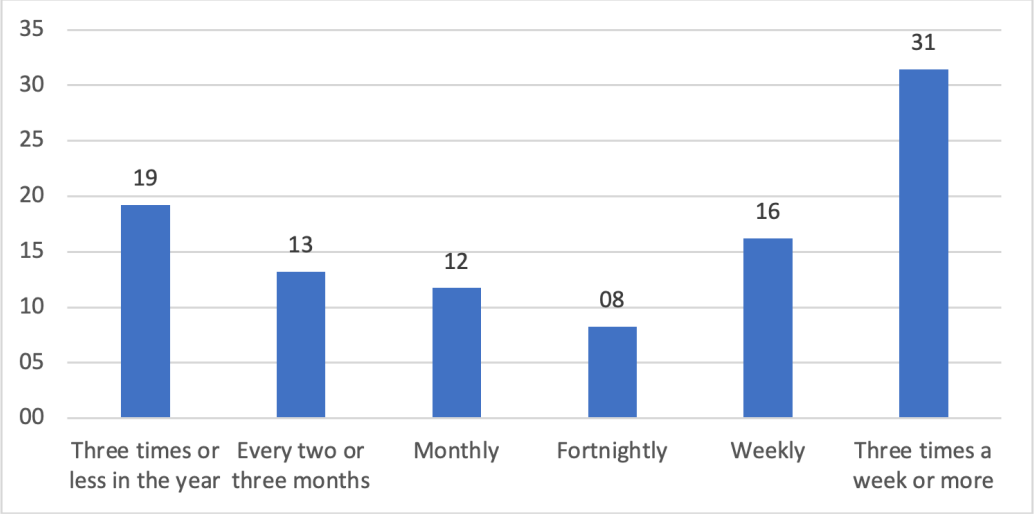

Figure 9. Percentage distribution of the answers provided by the substance users in the last 12 months.

The F indicator ranges, in the ALAMA data excluding non-consumers, from 0.01 (minimum base value) to 5.34, obtained by a severe poly-drug use subject. Some F values can be obtained both for single use and for poly-drug use (see list of base values), but all non-base values can only be obtained from poly-drug use. Considering the percentage of non-base values, indicated by p, it can be concluded that at least p% of users is poly-drug user and that at most (100-p)% of users use only one illegal substance. This p value for ALAMA data is 54%: at least 54% of subjects have used more than one illegal substance during the last 12 months.

Figure 10 shows the empirical distribution of the F indicator with values grouped into classes. Three local modal values can be observed, indicating the presence of three quite distinct groups of users in the sample: those with low frequency of use or poly-drug use, those with medium frequency and those with high frequency of poly-drug use.

The classification into three groups is similar to the one defined, before poly-drug use indicators were considered and properly measured, on the basis of the typical frequency trend shown in school surveys in the years 2010 and 2011 in Italy (Fabi et al. 2011). The three groups were then denoted:

- occasional consumers (low frequency);
- regular consumers (medium frequency);
- intensive consumers (high frequency).

This classification has been used in many reports from different countries and has been observed in various surveys among different populations, even if the limits that define the three groups may be different from one population to another.

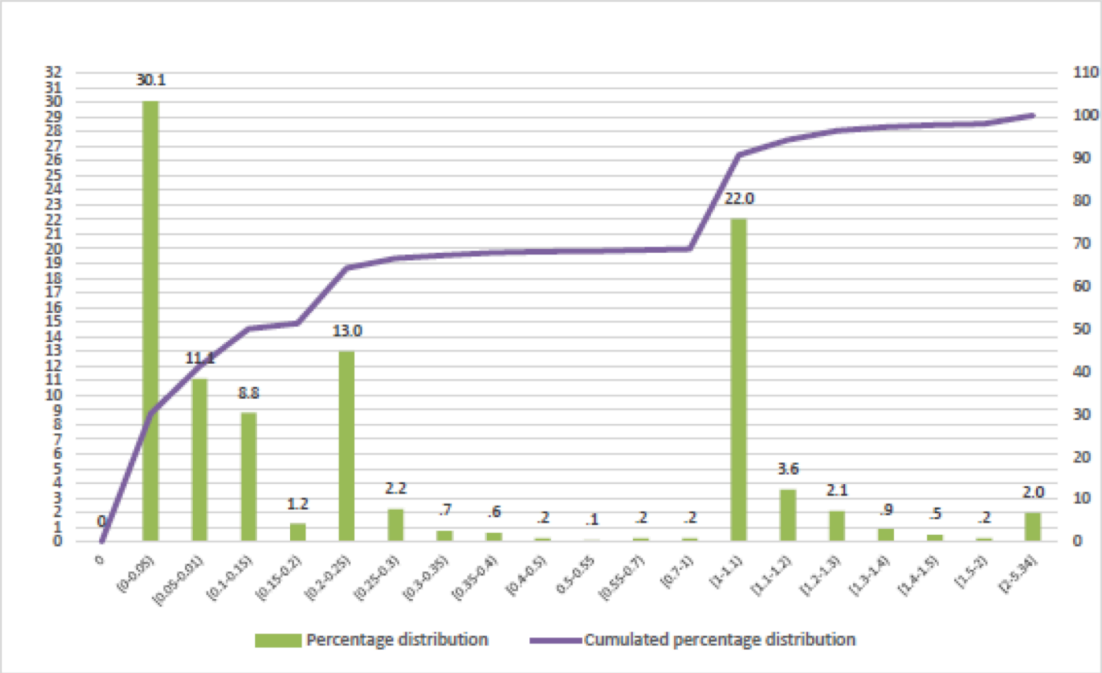

Figure 10. F indicator distribution (%, left axis) and empirical cumulative distribution (right axis).

Regarding the PDS indicators, Figures 11 and 12 show the presence of two characteristic groups in the ALAMA users according to the PDS^{self} indicator, while the PDS^{others} shows a homogeneous grouping around very low scores, as the empirical distribution shows a rather smooth behaviour.

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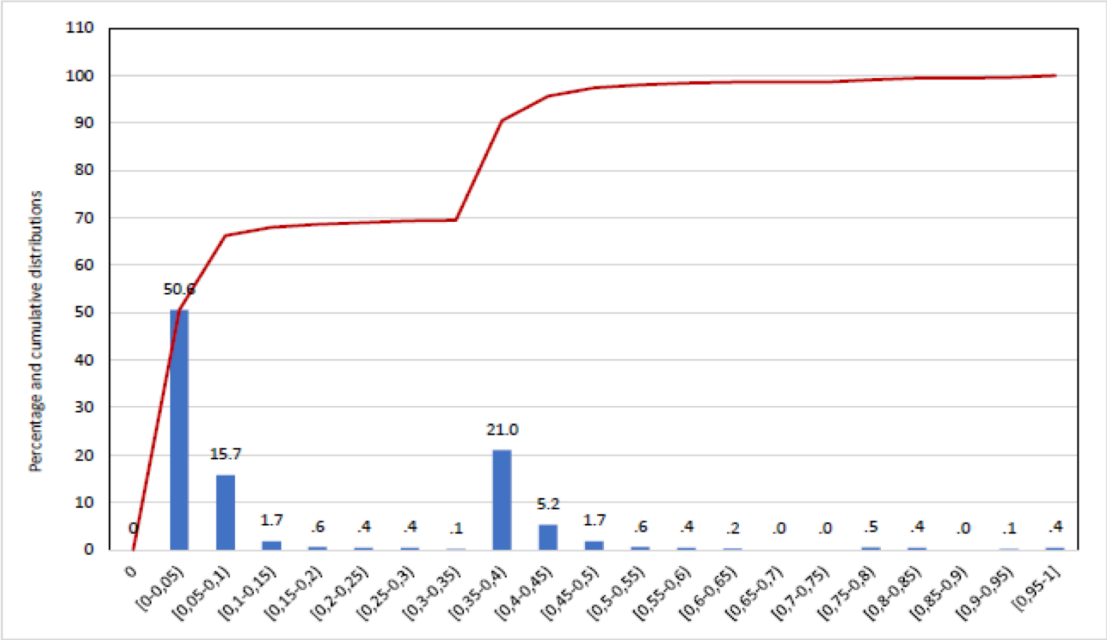

Figure 11. Percentage and cumulative distributions of $PDS^{self.}$.

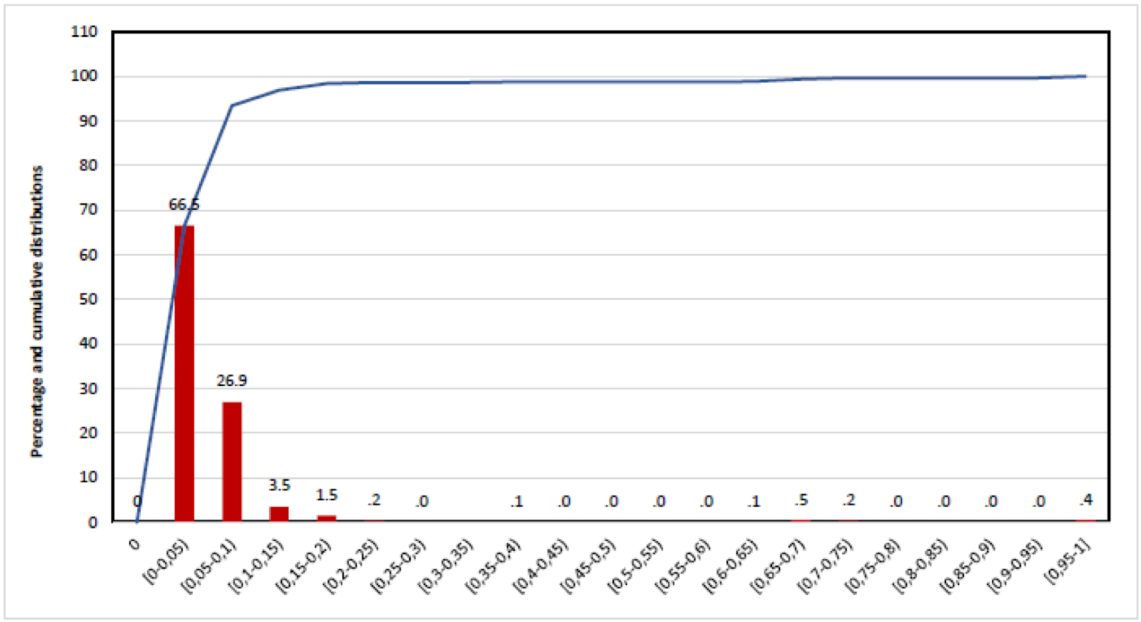

Figure 12. Percentage and cumulative distributions of $PDS^{others.}$.

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Possible relations between poly-drug use indicators and individual demographic/social variables

Thus, in the studied population, the PDS^{self} harm indicator seems the most indicative one in terms of harm prevention objectives. In particular, it becomes of interest to further characterize the "high" ($PDS^{self} \geq 0.35$) group.

One first interesting observation is that this group is characterized by a generally high frequency of use of one or, usually, more than one substance rather than use of particularly harmful substances as such. This can be seen by comparing Tables 2 and 3, but also by analysing the relationship of PDS^{self} and the FUS indicator.

The critical value of the F indicator which divides the population into non-intensive users of substances, mostly users of a single substance, and intensive users, mostly users of more than one substance, is 1. Let us therefore consider the two groups of users with FUS values such that $F < 1$ and $F \geq 1$. The two groups contain 68.7% and 32.3% of the sample, respectively.

If this classification is compared to the one representing "low" and "high" PDS^{self} ($PDS^{self} < 0.35$ and $PDS^{self} \geq 0.35$), it is seen that they are essentially equivalent, over 99% of subjects who have high or low F values have at the same time also high or low PDS^{self} values, only 6 subjects have high F and low PDS^{self}.

Given the unimodality and restricted range of the PDS^{other} distribution, it is not natural to make a division into two classes, but if we carried out, for example, the subdivision in values <0.05 and ≥ 0.05, we obtain two classes with very high correlation both with F and with PDS^{self} classification. In the case of F only 18 subjects have a high PDS^{other} and low F and 24 a high PDS^{other} and a low PDS^{self} (sample size=809).

Thus, in the present sample of individuals and with the present spectrum of used substances, the Frequency of use indicator is essentially equivalent to the Harm to self-indicator and high harm scores are obtained mainly through intensive use of substances and not through use of very "harmful" substances.

A second interesting observation is that the classification into "high" and "low" FUS does not correlate significantly (i.e. p-value > 10%) with classical demographic variables such as sex, age and

civil status and that only occupation (low F more frequent in students) and residence (low F more frequent outside big urban centres) show some correlation (both, p-value = 8%). Furthermore, the two variables occupation and residence are quite correlated as shown in Figure 13.

Unfortunately, although the ALAMA study protocol contained large quantities of information about the use of drugs, there were few questions related to other behavioural or relational variables, such as the ones formulated in the previously cited ESPAD study, where interesting relations were found with the latter variables. Data on the supply of substances should be analysed (at least via seizures data) to better understand systematic differences as, presumably, they are partly due to the variety of substances offered for sale in different places and to different people.

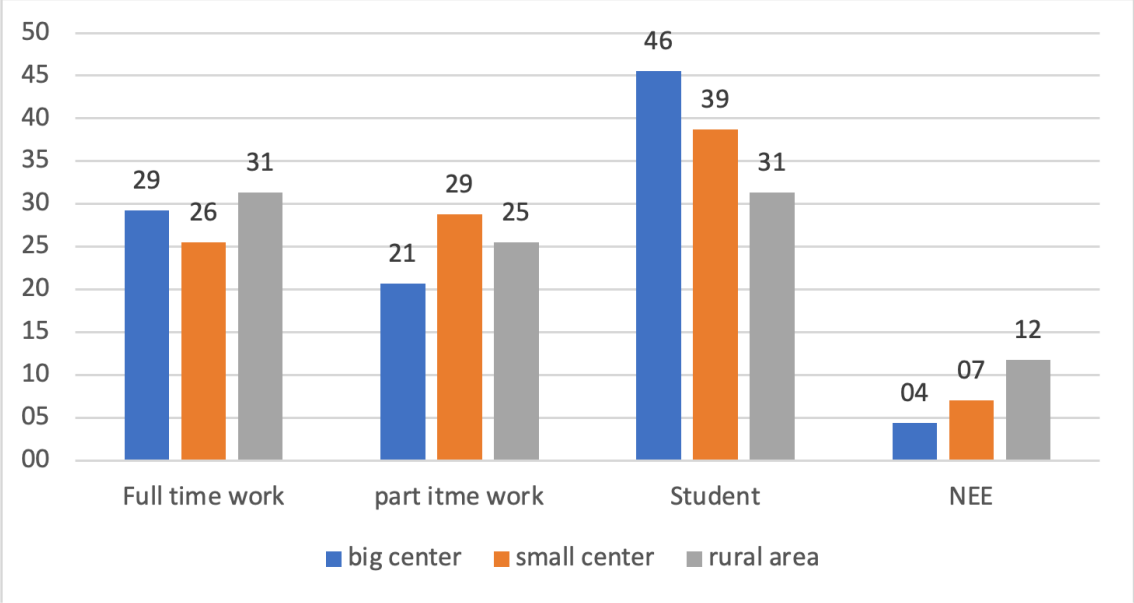

Figure 13. Percentage conditional distributions of the variable occupation with respect to residence

An important part of the work was the collaboration with experts in new substances who organised the classification and scoring of NPS of interest for the survey. Such kind of collaboration shows how to proceed in the case of new substances of interest are used for specific surveys to get the possibility of implying poly-drug use indicators.

Conclusions and suggestions

In the present study, we have both illustrated the new data on substance use, in particular NPS, among nightlife attendants, according to the ALAMA study results, and the use of poly-drug use indicators to summarize and allow an integrated analysis of these data, possibly useful for information and prevention work.

An important part of the work was the collaboration with experts in new substances who organised the classification and scoring of NPS of interest for the survey. It was also shown how to proceed in the case of new substances of interest for specific studies to get the possibility of using poly-drug use indicators.

It is interesting to note that, at least in the Italian available data, the use of NPS is not widespread, if ecstasy is considered as "classical", and that the main substances used are alcohol, tobacco, cannabis and ecstasy. All other substances seem to be "experimental", in the sense that they may have been occasionally used, but their recent use is not frequent.

Another important observation is that the patterns of use do not seem to correlate to a large extent with classical demographic/social variables. Previous works (Colasante et al., 2019 and Fabi et al., 2023) rather point towards relational/psychological variables such as relations with parents (at least for young subjects), school results (again for young people) that, more in general, could be thought of as extending to measurement of satisfaction with current situation, maybe relations with others, etc... Variables of this kind that correlate more with substance use/abuse would be of value for information, prevention measures and should always be collected in future surveys.

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Footnotes

[1] http://www.espad.org/report/home

[2] https://www.politicheantidroga.gov.it/media/2215/application-form_alama-nightlife-revision-2016.pdf

[3] https://www.eranid.eu/home/

[4] http://www.emcdda.europa.eu/publications/technical-reports/monitoring-drug-use-in-recreational-settings-across-europe_en

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