Chemsex from Drug Checking Services: descriptive study on methamphetamine, mephedrone, and other synthetic cathinones

El chemsex desde los Servicios de Análisis de Sustancias: estudio descriptivo sobre la metanfetamina, mefedrona y otras catinonas sintéticas

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Resumen

Antecedentes. Los Servicios de Análisis de Sustancias (SAS) han demostrado ser una intervención eficaz que permite acceder a población a prácticas de consumo más seguras. Este estudio se centra en la población usuaria de chemsex. Material y métodos. Análisis descriptivo de las muestras de sustancias cedidas por personas participantes en prácticas de chemsex, enfocándose en metanfetamina (MET), mefedrona y otras catinonas sintéticas. Los datos fueron recopilados por el Servicio de Información, Análisis de Sustancias y Asesoramiento sobre Sexualidades (SIASAS) de Chem-Safe (Energy Control). Se examinaron las características sociodemográficas de las personas usuarias, los contextos de adquisición de las sustancias y su composición química. Resultados. La población de personas usuarias del SIASAS de Chem-Safe que participan en sesiones de chemsex está compuesta principalmente por hombres de mediana edad. Se han analizado 15 tipologías de sustancias diferentes con predominancia de MET y catinonas. En la primera de ellas está presente la adulteración por adición únicamente y un predominio de la vía fumada (50%), mientras que en el caso de las catinonas sintéticas se identifica un elevado índice de adulteración por sustitución y un predominio de la vía endovenosa y esnifada (41,67% respectivamente). Conclusiones. Las principales sustancias analizadas desde el SIASAS son la MET y las catinonas sintéticas. Entre ambas existen diferencias tanto en su modo de obtención, como contexto de adquisición, administración y adulteración, lo que comporta un aumento de los riesgos para la salud de las personas usuarias.

Palabras clave

Chemsex; uso sexualizado de sustancias; análisis de sustancias; reducción de riesgos; prevención basada en la evidencia; mefedrona; metanfetamina; catinonas sintéticas; salud; LGBTI+.

Abstract

Background. Drug Checking Services (DCS) have proven to be an effective intervention that allows access to safer consumption practices for the population. This study focuses on the user population engaged in chemsex practices. Materials and Methods. A descriptive analysis of substance samples provided by individuals participating in chemsex practices, with a focus on methamphetamine (METH), mephedrone, and other synthetic cathinones. Data were collected by the Drug Checking and Sexuality Counseling Service (DCSCS) of Chem-Safe (Energy Control). Sociodemographic characteristics of users, substance acquisition contexts, and chemical composition were examined. Results. The Chem-Safe DCSCS user population engaging in chemsex sessions consists predominantly of middle-aged men. Fifteen different substance typologies were analyzed, with METH and cathinones predominating. In the case of METH, adulteration through addition was found, with a predominance of the smoked route (50%). Synthetic cathinones showed a high rate of adulteration through substitution, with a preference for intravenous and insufflation routes (41.67% each). Conclusions. The main substances analyzed by DCSCS are METH and synthetic cathinones, revealing differences in acquisition, administration, and adulteration contexts. This contributes to an increased health risk for users.

Keywords

Chemsex; sexualized substance use; drug checking; risk reduction; evidence-based prevention; mephedrone; methamphetamine; synthetic cathinones; health; LGBTI+.

INTRODUCTION

Since 1992 in Europe, DCS have been key elements in Risk Reduction (RR), providing users with hard-to-access information on the composition of the substances they use. In Spain, since 1999, Energy Control has improved access to these services through advanced analytical techniques and the receipt of samples by mail (Barratt et al., 2018).

Traditionally, drug treatment efforts have been directed at preventing the initiation of drug use and at the most problematic profiles. Thanks to the DCS, it has been possible to intervene in young people with non-problematic use, a population previously neglected (Brunt, 2017). Despite these advances, criminalisation and stigmatisation (especially towards minority groups such as the LGBTI+ population) continue to limit access to these services (Harm Reduction International, 2022). Furthermore, on the part of the LGBTI+ community, LGTBphobia and social prejudice have been barriers to prioritising certain relevant aspects of health within the community (Rodríguez et al., 2017).

In response, in 2021, DCSCS was launched by Chem-Safe (Energy Control), in collaboration with Apoyo Positivo, Stop and Gais Positius.

The effectiveness of DCS

Meta-analyses show that DCS positively impact substance use, influence behavioural intention, and continued behaviour (Guirguis et al., 2020; Maghsoudi et al., 2022). In addition, their usefulness in public health interventions is highlighting the need for further support despite the legal framework. However, they also underline the importance of adapting these services to the specific needs of the population. According to the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA, 2023), preventive communication from DCS is effective because it focuses on a positive approach aimed at the benefits of adopting certain strategies, rather than on prejudices and negative consequences. However, despite the evidence, these measures lack adequate support in most territories in Spain.

The reality of the unregulated market

In 2008, the United Nations Office on Drugs and Crime (UNODC, 2008, p. 220) recognised a series of "unintended consequences" of international control. Among them, it highlighted the phenomenon of "substitution", i.e., how the increased prosecution or control of a specific substance induces suppliers and users to opt for alternative substances with similar effects, but subject to less severe control. When this replacement is unknown to the user, it is called adulteration. There are mainly two typologies: adulteration by addition, which occurs when other psychoactive compounds are added to a given substance, and adulteration by substitution, where the original substance is completely replaced by another (Vidal. et al., 2022).

The unregulated market is opaque, dynamic and without quality controls. This reality implies considering an inconsistency between people's expectation of consumption and the actual composition of substances, all leading to a discrepancy that may vary according to the specific market and moment in time (Barratt & Ezard, 2016; Dahm et al., 2023).

Therefore, the objective of this study is to describe the population and characteristics of the samples analysed by DCSCS provided by chemsex users.

BACKGROUND

Spain

Although approximations have been made in Spain on trends in sexualised substance use in this population (Cabezas et al., 2021; Íncera D. et al., 2022; Íncera-Fernández et al., 2021; Instituto de adicciones, 2023; Whitlock et al., 2021), and even in the heterosexual population (Íncera-Fernández et al., 2022), all of them were based on the expectation of consumption or, in other words, on the trust placed by users in their providers.

France

There are other DCS that incorporate the sexualities approach in Europe, such as Checkpoint Zurich in Switzerland, Kemsex (DrogArt) in Slovenia or Drug Checking Berlin in Germany. However, the only detected study on pharmacovigilance is the one conducted by Batisse et al. (2022), in France. This one analysed chemsex cases reported to the French Addiction Surveillance Network between January 2008 and August 2017. Reports from professionals, self-reports and analyses from pharmacoepidemiology programs, including *post-mortem* and judicial toxicological analyses, were used.

A comparison of data from before and after 2014 was carried out to describe the evolution of consumption practices. Of the 235 cases studied, a total of 345 psychoactive substances were identified. Synthetic cathinones were predominant, present in 71% of the cases. The most prominent were 4-MEC (34%), 3-MMC (26%) and 4-MMC (26%). Cocaine was reported in 31% of cases, followed by GHB (15%) and poppers (14%). An increase in the use of METH and the emergence of New Psychoactive Substances (NPS) such as ethylphenidate, α-pyrrolidinovalerophenone (a-PVP) and α-pyrrolidinoenanthophenone were observed. A significant number of non-fatal GHB-induced comas (22 cases) and an increase in deaths (24 cases) associated with the use of multiple substances, especially synthetic cathinones, and the practice of slam.

The study does not specify the percentage of results obtained through self-recording compared to those obtained by analytical techniques. This is a relevant aspect, since only in 26 cases (11%) were objective analytical tests used, as mentioned above.

MATERIALS AND METHODS

Study design

A descriptive observational study was carried out using the data obtained from the samples provided by users of Chem-Safe's DCSCS (Energy Control), in collaboration with Apoyo Positivo, Stop and Gais Positius. A general analysis of the sociodemographic data of the profiles in the application was carried out, and then a more detailed description of the most frequently analysed samples was made.

Study samples

The substances in the study of this research are composed of a non-randomly

selected sample, which is made up of those substances given up by people who voluntarily attended DCSCS in the period from March 16, 2021, to September 28, 2023. The service has been offered only to the chemsex user population, and was announced for the exclusive analysis of METH, mephedrone, and other synthetic cathinones. However, users who requested analysis of other substances were not denied the service. To proceed with sample collection, an individualised interview is used. The final database consists of 164 analysed samples.

Data collection

The data were obtained from the four Energy Control offices (Andalusia, Balearic Islands, Catalonia and Madrid) and from the offices of the collaborating entities Stop (Barcelona) and Apoyo Positivo (Madrid). To analyse the sample, a profile is required in our analysis application. There are two types of profiles: an individual one, generated for the users who access DCSCS from Chem-Safe; and the other one for the organisations. The latter is used to respect data privacy, so that users from other entities can also access DCSCS without the need to generate a specific profile. Therefore, all this implies that the samples of 2 of the 27 profiles belong to an undetermined number of users. The scope of the DCS is difficult to determine since, in addition to the aforementioned situation, the substance may be shared with other people.

Description of the application

The Analysis Application is a secure and confidential web tool that requires a profile and password for access. Once authenticated, users can view the list of all the samples they have analysed and access the results, which include the identification and/or quantification of the components in each sample. In addition, personalised advice on RR is offered based on the results obtained.

Sample collection

During the first visit to the service, prior to counselling and sample collection, a welcome session is provided to present the program, its objectives, how the service works, and the terms and conditions related to privacy. To analyse a sample, it is necessary for the user to register in the Application, which generates a unique identification code for the sample (*Sample* Identifier), associated with a second numerical code that identifies the user (*User* Identifier). The creation of both codes implies the generation of a profile and the acceptance of the privacy terms and conditions. With respect to the collaborating entities, privacy measures are maintained by assigning a profile to each one (being the responsibility of these entities to associate the analysed sample to the persons accessing from their services). The detailed script of this structured procedure is available in Annex 1 of the study.

Analytical techniques

After collection, coding and proper labelling, the samples are transferred to the laboratory for preparation and analysis. The analytical techniques used vary according to the nature and composition of the substance (TEDI Network, 2022):

1. FTIR-ATR: Fourier Transform Infrared Spectroscopy (Zapata et al., 2021).

2. GC-MS: Gas chromatography-mass spectrometry (Kintz & Cirimele, 1997).
3. LC-MS: Liquid chromatography coupled to mass spectrometry (Couchman & Morgan, 2011).
4. UV/Vis: Ultraviolet spectroscopy (Burgess, 1993).

Study variables

The different variables used in the study are as follows:

1. Gender: qualitative variable with response options such as male, female, or other.
2. Age: numerical variable.
3. Delegation where the sample was collected: qualitative variable that indicates in which of Energy Control's offices the sample was collected.
4. Acquisition context: qualitative variable reflecting the spatial context in which the substance was acquired by the user. Options include *Deep-Web*, on the street, at party, staying with dealer, and other.
5. Dealer: variable that indicates the link with the source of acquisition of the substance, with options such as trusted dealer, unknown dealer, close person (friend or relative), found, don't know/no answer, and other.
6. Method of analysis: indicates the laboratory analytical technique used to identify and quantify the analysed sample.
7. Sample origin: qualitative variable indicating the place of origin of the sample.
8. Discrepancy Index (DI): quotient that compares the number of samples in which the substance indicated by the user was not detected among the total number of samples analysed.
9. Adulteration index: quotient that reflects the number of samples that include some substance, in addition to the one expected by the user, in the analysis.
10. Main substance detected in the analysis: qualitative variable that describes which substance was found in the greatest proportion in the sample.
11. Adulterants: qualitative variable that identifies other substances detected in addition to the substance sought.
12. Price: Cost of the substance paid by the user, expressed in euros per gram.
13. Consumption: If the substance to be analysed has been consumed prior to analysis.
14. Substance consumed prior to analysis: Percentage of samples that have been consumed by the user prior to being submitted for analysis.
15. Route of administration (ROA): Ratio between the route of administration used for the consumption of substances analysed prior to their use, with respect to the total number of samples consumed without prior analysis.

Statistical Analysis

For the statistical analysis of this study, the software 'R Studio', version RStudio 2023.06.2+561 'Mountain Hydrangea' Release designed specifically for Windows systems, was used. This software has facilitated the performance of various types of analysis, adapted to the nature of the variables involved in the research.

For quantitative variables, measures of central tendency were applied to understand the location of the data set. Depending on the normality of the variables, both mean and median have been used, informed by the nature of the variable. In addition, measures of dispersion such as standard deviation have been used. In the case of qualitative variables, measures of frequency and proportions have been used for their description.

RESULTS

In the present study, 164 samples received at DCSCS were analysed, and 15 different types of substances were submitted by users.

The sociodemographic characteristics of chemsex users who accessed the DCSCS were initially examined. These results can be seen in Table 1.

Regarding the gender of the users (n = 28), they were mainly men (96%) with the exception of one user, who was a trans woman (4%). In terms of age, the participants presented a varied age range between 21 and 58 years, with a median of 39 years and a standard deviation of 8.75 years. Regarding the geographical location of sample collection, most samples were received in Barcelona, thus representing 96.71% of the total. Andalusia and Madrid contributed 1.97% and 1.32%.

Table 1. Socio-demographic characteristics of the users attended from the DCSCS

Gender (n = 28)		
	Males (%)	96
	Women (%)	4
Age (n = 25)		
	Range (years)	21 - 58
	Median (years)	39
	Standard Deviation (years)	8,75

Table 2 shows the relative percentage of the various substances analysed, highlighting a wide variability. METH stands out with 53.66% of the total substances identified and followed by 4-MMC, which also features prominently, accounting for 16.46% of the total. Other notable substances include MDMA (9.15%), cocaine hydrochloride (4.26%), and ketamine (3.05%). Also detected in smaller proportions were 3-MMC (1.83%), a-PVP (1.83%), and others such as 2C-B, amphetamine sulphate (speed), a-PHP, estradiol cypionate, Tusi, 3-CEC in less than 1%.

Methamphetamine

Table 3 details the characteristics of the samples labelled as "Methamphetamine", with a total of 87 samples analysed. Most were acquired by staying with the dealer (86.20%), followed by purchases on the street (4.60%) and through the *Deep-Web* (3.44%). A smaller percentage was associated with their acquisition at a party (1.15%) or in unspecified circumstances (3.45%).

Most of the participants obtained the substance from a trusted dealer (77.01%),

Table 2. Relative percentage and typology of samples analyzed in the DCSCS (n = 164)

2C-B (Nexus)	0,61
3-CEC	0,61
3-CMC (Clophedrone)	1,83
3-MMC (Metafedrone)	5,49
4-Cl-alfa-PVP	1,83
4-MMC (Mephedrone)	16,46
Alfa-PHP	0,61
Amphetamine Sulfate (Speed)	0,61
Cocaine HCL	4,26
Unknown	0,61
Estradiol Cypionate	0,61
Estradiol Cypionate	3,05
MDMA	9,15
Methamphetamine (Tina)	53,66
Tusi	0,61

while 12.64% did so from an unknown dealer. A small percentage either found the sample (1.15%) or did not provide information (2.30%). Some (2.30%) obtained it from people close to them, such as friends or relatives.

LC/MS was the most commonly used technique to analyse the METH samples (72.41%), followed by FTIR-ATR (27.59%). Most of the samples came from Barcelona (97.70%), with a small percentage coming from Madrid (2.30%).

METH purity ranged from 18 to 97%, with a median of 75.90% and a standard deviation of 13.73%. No samples were found to be non-METH (0% ID), but 4.6% of samples were detected adulterated with caffeine, dimethyl sulfone (DMSO2) and n-isopropylbenzylamine.

Almost half of the people who used the service had not consumed the substance prior to analysis (49.43%). Of those service users who had consumed the substance prior to analysis, 50% smoked it, followed by consuming it rectally (27.27%), intravenously (13.64%), and lastly insufflated (9.09%). The cost on the market ranged from 20 to 80 euros, with a median of 60 euros.

NPS: the Synthetic Cathinones Group

Table 4 shows the characteristics of the 44 samples analysed in the DCSCS, categorised as synthetic cathinones, being the group with the highest presence. These substances were acquired in different contexts, with a *dealer* encounter predominating in 50% of the cases. Internet purchases accounted for 22.73%, followed by purchases on the *Deep-Web*, at parties and on the street, each with 4.55%. Some 4.55% of the samples did not specify the context of acquisition, and 6.81% came from other unclassified contexts.

Regarding the source of acquisition of the cathinones, 38.64% of the samples were obtained through trusted dealers, while 31.81% came from unknown suppliers. Some 18.18% were acquired from other unspecified sources, 4.54% preferred not to disclose the source, and 2.27% corresponded to persons close to them, such as friends or relatives.

The predominant method of analysis for synthetic cathinones was GC/MS, used in 88.64% of the cases. The FTIR-ATR technique was used in 9.09%, and 2.27% of the samples were analysed by LC/MS.

Table 3. Characteristics of the samples brought to the DCSCS under the label of Methamphetamine (n = 87)

Context of acquisition (%)			
	Deep-web	3,44	
	On the street	4,60	
	At the Fiesta	1,15	
	Don't know / No answer	1,15	
	Meeting with the Camel	86,20	
	Other	3,45	
Dealer (%)			
	Trusted Dealer	77,01	
	Dealer Unknown	12,64	
	Found	1,15	
	Don't Know / No Answer	2,30	
	Other	4,60	
	Close person (Friend or relative)	2,3	
Method of Analysis			
	LC/MS	72,41	
	FTIR-ATR	27,59	
Sample Origin			
	Barcelona (%)	97,70	
	Madrid (%)	2,30	
Discrepancy index (%)		0	
Adultration rate (%)		4,60	
Principal Substance Detected in the Analysis			
	Methamphetamine	(%)	
		Purity range	18 - 97
		Median	75,90
		Standard Deviation	13,73
Adulterants			
	Caffeine (n=1)		
		Percentage of samples with caffeine (%)	1,15
		Range of sample concentrations (%)	2
	Dimethylsulfone (DMSO2) (n = 1)		
		Percentage of samples presenting it (%)	1,15
		Range of sample concentrations (%)	No cuantificado
	N-Isopropylbenzylamine (n = 2)		
		Percentage of samples showing it (%)	2,3
		Range of sample concentrations (%)	No Cuantificado

(table continued on next page)

Substance consumed prior to analysis (%)		50,57
Route of Administration (%)		
	Endovenous	13,64
	Snorted	9,09
	Smoked	50
	Rectal	27,27
Price (€) (n = 83)		
	Range	20 - 80
	Median	60
	Standard Deviation	15,27

Geographically, samples sold as "cathinone" came mainly from Barcelona (61.36%) and Madrid (34.09%), with smaller contributions from Las Palmas, the Netherlands, and other places (2.27% each).

The cathinones analysed showed a variety of substances, with3-CMC being the most prevalent (27.27%), followed by 3-MMC (22.72%), and alpha-PHP (13.63%). Other compounds were identified in lower percentages, detailed in Table 4. In addition, adulterants such as paracetamol, phenacetin, and 2-MMC were found in a sample combined with 3-CMC. The high ID of 72.72% in this category of substances, mainly caused by adulterations by substitution, is remarkable.

Half the people had consumed the substance prior to the analysis (54.54%). Of this group, the intravenous and insufflated routes were used with equal frequency (41.67%), followed by the oral route (16.67%). The price of cathinones showed a wide variation, ranging from 10 to 80 euros per gram. The median price was €40, with a significant standard deviation of €16.57.

DISCUSSION

The effectiveness of these strategies depends not only on the development of cultural competencies, but also on institutional support. In addition, the development of more effective methodologies and the availability of qualified professionals to adequately respond to the specific needs of the population is crucial (Brunt, 2017; EMCDDA, 2023). A clear example is the population that develops a problem with intravenous heroin use. Interventions delivered from supervised consumption rooms using FTIR-ATR not only facilitate access to DCS, but also function as a more effective detection and early warning system. This is particularly relevant in this type of population, as the type of route of administration used implies a greater vulnerability to toxic adulterants such as synthetic opiates.

Market variability

The results of this study provide a reduced, but detailed, view of a broader reality, far removed from the usage trends known to date. The predominance of METH in Barcelona and its absence in Madrid suggests that territorial differences in consumption do exist. The variability of the results obtained

Table 4. Characteristics of samples analyzed in DCSCS sold as synthetic cathinones (n=44)

Context of acquisition (%)		
	Deep-web	4,54
	On the Internet	22,73
	On the street	4,55
	At the Fiesta	4,55
	Don't know / No answer	4,55
	Staying with the Camel.	50
	Other	9,53
***Dealer* (%)**		
	Dealer trusted	38,64
	Dealer Unknown	31,81
	Found	2,27
	Don't Know / No Answer	4,54
	Other	20,45
	Close person (Friend or relative)	2,27
Test Method (%)		
	GC/MS	88,64
	FTIR-ATR	9,09
	LC/MS	2,27
Origin of the sample (%)		
	Barcelona	61,36
	Madrid	34,09
	Netherlands	2,27
	Others	2,27
Discrepancy rate (%)	72,72	
Adulteration index (%)	6,8	
Main Substance Detected in the Analysis		
	2-MMC (Ortomephedrone)	4,54
	3-CEC	2,27
	3-CMC	27,27
	3-MMC	22,72
	4-CMC	9,09

(table continued on next page)

	4-MMC (Mephedrone)	6,81	
	Alpha-PHP	13,63	
	a-PiHP	2,27	
	GBL	2,27	
	Ketamine	4,54	
	MDMA	2,27	
	Methamphetamine	2,27	
	Paracetamol	2,27	
Adulterants			
	Paracetamol		
		Percentage of samples presenting it (%)	2,27
		Range of sample concentrations (%)	Not quantifiable
	2-MMC		
		Percentage of samples presenting it (%)	2,27
		Range of sample concentrations (%)	Not quantifiable
	Phenacetin		
		Percentage of samples presenting it (%)	2,27
		Range of sample concentrations (%)	Not quantifiable
Substance consumed prior to analysis (%)		54,54	
Route of administration (%)			
	Endovenous	41,67	
	Snorted	41,67	
	Oral	16,67	
Price (€) (n = 31)			
	Range	10 - 80	
	Median	40	
	Standard Deviation	16,57	

and not expected in synthetic cathinones (ID 72.72%) reflects specific trends in the environments where chemsex is practiced, aligning with previous studies (Batisse et al., 2022). In turn, this shows significant risks in terms of adulteration depending on the territory. In Barcelona, adulteration of METH (ID 4.6%) is not a matter of particular concern, but the route of administration used is, as it is smoked in 50% of cases.

It is also necessary to emphasise, with regard to the difference between the IDs of these two large groups, the type of dealer. 31.81% of the synthetic cathinone samples come from unknown dealers (vs. 38.64% trusted dealers). In contrast, with METH it is 12.64% (vs. 77.01% trusted dealers). Although there is no direct correlation, it may influence the quality of the substances. However, there are other factors beyond the scope of this study that may influence this, such as advertising strategies in "Clearnet" markets (see amimichem, 2023).

Consumption and risks detected in methamphetamine use

The results obtained through interviews indicate that the most commonly used route of administration for METH is smoked. According to the (EMCDDA, n. d.), this route, together with injection, is associated with higher risks. On the other hand, vaporised (smoked) ROA in a pipe has a reduced bioavailability. According to Harris et al. (2003), on average, only 37.4% of what is introduced into the pipe is absorbed.

The technique of vaporising (smoking) METH in a glass pipe is complex and carries significant risks. It is essential to emphasise that this technique is not recommended for people with no previous experience. One of the main challenges is that METH is not efficiently utilised, i.e., the amount of the substance absorbed is less than what is needed to produce the desired effects. If the bioavailability is further reduced or the appropriate dose is not calculated, more than one inhalation may be necessary to achieve the desired effects.

It has been known for decades that the substance's own characteristics do not fully explain the consequences of its effects, but do influence the associated risks (Alexander et al., 1978; Hadaway et al., 1979; Alexander et al., 1981; Zinberg, 1984). Factors such as the positive reinforcement associated with the effect of the substance, as well as its onset and duration of effects, are elements that influence the risks of the route of administration (Robbins & Everitt, 1999; Volkow & Morales, 2015; Lüscher et al., 2020). However, in this case, the effects are not directly associated with a specific behaviour, but rather with the accumulation of an undetermined number of puffs. It corresponds more to a variable ratio operant reinforcement (Skinner, 1965), since a single action does not guarantee the desired effects. In addition, the rapid onset and disappearance may create an expectation of "almost reaching" the desired effects. According to Frustration Theory (Reid, 1986), failure to achieve an anticipated goal acts to reinforce the behaviour. This type of reinforcement is known to generate response patterns that are difficult to extinguish such as compulsion and is closely linked to gambling.

Finally, regarding the presence of n-isopropyl benzylamine as an adulterant, according to Xu et al. (2022), users who used METH adulterated with this compound had headaches. This substance is not psychoactive, but its associated risks are unknown due to a lack of research.

Consumption and risks of synthetic cathinones

The study reveals a high ID in these substances (72.72%), especially in the 4-MMC market. Therefore, this variability in certain types of market is confirmed (Dahm et al.,

2023). Another noteworthy aspect is about the recent appearance of 2-MMC, attributable to the "replacement effect" produced after the control of 3-MMC and 3-CMC in February 2023 (Ministry of Health, 2023). These substances were used to replace 4-MMC, and the available information was superior to 2-MMC, making it difficult to implement specific preventive strategies.

Regarding ROA and the risk factors mentioned above, the shorter duration of 3-MMC and especially 3-CMC compared to 4-MMC is noteworthy (Energy Control, n. f.-a, n. f.-b, n. f.-c). The rapid extinction of their effects contributes to a higher probability of developing compulsive use. In addition, there is a high use of insufflated and injected ROA, both of which intensify the risks compared to oral ROA. This is not only because they are ROA with a greater potential to generate compulsion, but also because of the idiosyncrasies of these substances. Their causticity, influenced by their pKa (acid dissociation constant, an intrinsic characteristic of the non-modifiable substance) and molecular instability (bromine, a reactive and irritant compound, is released in the form of impurities), leads to additional implications in their use by certain routes (Mcdermott et al., 2011; Wang et al., 2022).

Finally, it is important to highlight the implications of ID in the 4-MMC market, especially in contexts where use may be shared. Although it is not clear whether the situation is comparable to that described by Batisse et al. (2022), the high ID, the emergence of previously undetected substances following legislative changes, and the potential shared use by several people who do not know the exact composition of the substances, are factors that indicate a complex scenario, particularly for *slam* users.

CONCLUSIONS

This study highlights DCSCS as an efficient tool for the monitoring of substances consumed by the chemsex population. Adequate implementation, adaptation and evaluation of this service could result in significant benefits for the health of these individuals. In addition, access to DCSCS could enrich the existing knowledge on this phenomenon, optimising the health response and having a favourable impact on public health.

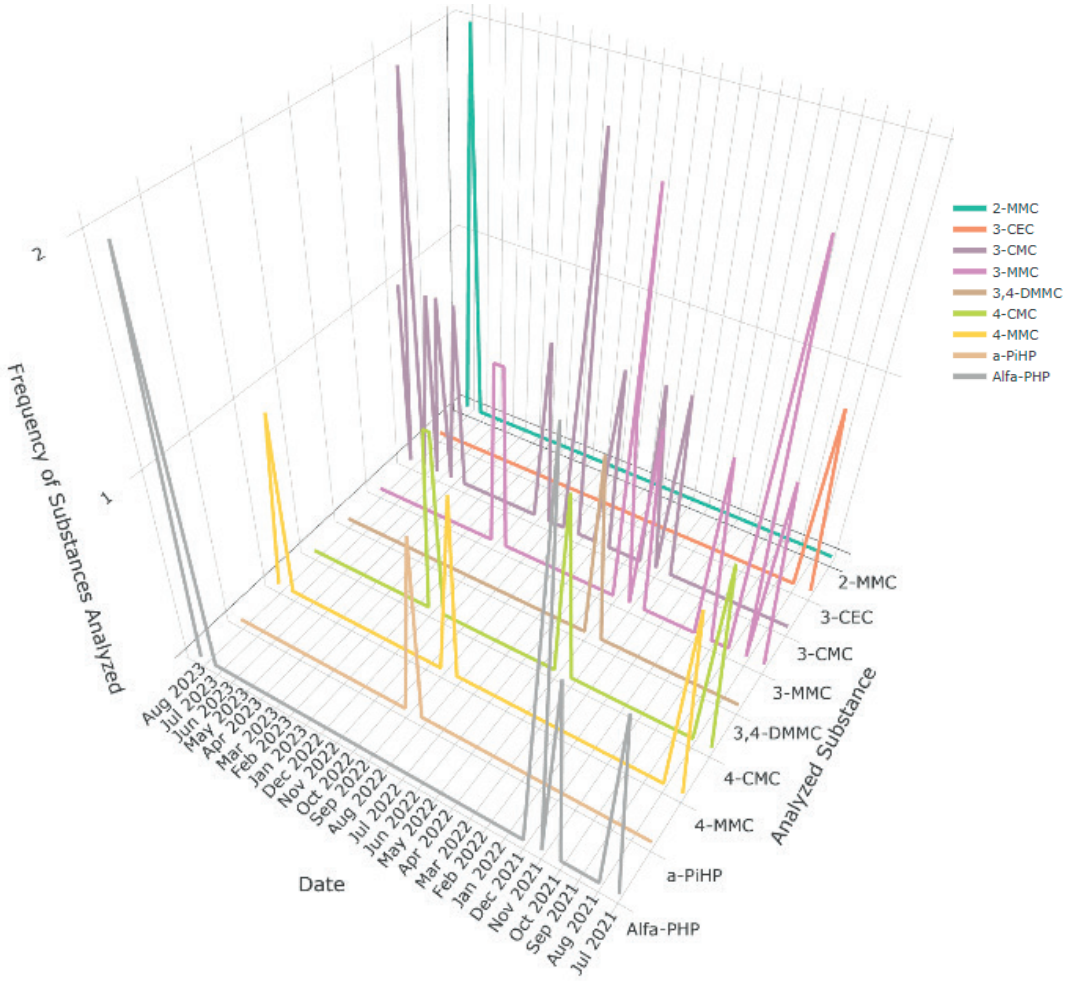
The main users of the analysis service were middle-aged men, who were mainly interested in analysing samples of methamphetamine and synthetic cathinones. In relation to METH, all samples contained the expected active ingredient with a low rate of adulteration. Meanwhile, for synthetic cathinones, active ingredients different from those expected were identified in most of the samples analysed, which implies an increased risk for the user.

Territorial differences highlight the need for intervention strategies adapted to each specific context, considering local particularities in the market and consumption practices.

The changing and complex dynamics of the unregulated market for synthetic cathinones highlight the importance of continuous monitoring to mitigate the associated risks inherent to adulteration and substance substitution phenomena (figure 1).

Finally, the prevalence of RoA in the use of METH and synthetic cathinones, particularly through the smoked and injected routes, highlights a greater need for an approach adapted to the reality of the territory and respectful of the decisions of the user population. To achieve this, the development and improve-

Figure 1. Time evolution of the frequency of New Psychoactive Substances detected



Note. This figure illustrates the frequency with which different NPS, from the group of synthetic cathinones, have been detected throughout the study period. The vertical axis represents the number of times each substance was detected. On the horizontal axis, the timeline is shown.

ment of effective strategies and methodologies, such as preventive communication from RoR, is essential. In summary, there is a general lack of knowledge about the implications of the unregulated market and the idiosyncrasies of the substances used, which underlines the need to increase training and education in this area.

LIMITATIONS AND STRENGTHS

There is a probable "selection bias" given that our sample is of non-random origin, which limits the representativeness of the results and the external validity of the findings and conclusions. The sample studied comes from people who have voluntarily attended the DCSCS, accessing it directly or through different programs aimed at different profiles of the same chemsex user population. Among these, Chem-Safe (Energy Control), a program focused on the prevention of problematic substance use. The collaborating programs, Chemsex Support (Stop) and Sex, Drugs and You (Apoyo Positivo), operate within the LGBTI+ community and sexual health framework, offering therapeutic accompaniment and risk and harm reduction counselling.

The difficulty of making the service available in regions outside Catalonia has limited its representativeness and access to certain profiles. In addition, the notable use of the VI in the consumption of synthetic cathinones could be related to the specific profile of users attended by Apoyo Positivo.

Therefore, the interpretation of the results should be made with these limitations in mind. Although the data obtained from analytical techniques are reliable, their proportion and consumption practices require further research to increase both the external validity and robustness of these findings.

FREE AND UNIVERSAL PROJECT

On the other hand, since part of the results were collected through structured interviews carried out by different interviewers, an "interview bias" may have occurred. This bias can occur when there is some variability in the way the interview is conducted and, in the collection, obtained from it. In order to reduce the impact of this bias, all interviews were conducted with the same script and responses, and all interviewers underwent standardised training in both the interview process and the use of these data collection tools.

ETHICAL CONSIDERATIONS

Within the framework of this observational research, rigorous ethical protocols were adopted to safeguard the privacy and confidentiality of the users whose data were analysed. It is essential to emphasise that all the information was processed in a completely anonymized manner, thus guaranteeing full protection of the identity of the participants involved in the study. Participation in the DCSCS was voluntary and informed consent was obtained for the use of these data prior to their collection, fully respecting the principle of autonomy and freedom of the people who participated in the study.

The research team assumes the ethical responsibility to use the data exclusively for

the stated scientific purposes, ensuring confidentiality throughout all stages of the study - from collection to presentation of results. In addition, the willingness of the investigators to answer any additional questions or ethical concerns that may arise in the context of this observational research is contemplated.

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ANNEX I

Analysis application questionnaire

User

1. E-mail address
2. Username
3. Phone
4. Date of birth
5. Genre
6. Password
7. Repeat the password
8. Delegation
9. Privacy terms and conditions

Substance

1. Alias
2. Substance sold as
3. Variant
4. Form
5. Color
6. Front image
7. Rear image

Consumption

1. Administration
2. Dose
3. Mixed with
4. Remarks
5. Main effects
6. Side effects

Collection

1. Origin
2. Location
3. Supplier
4. Context
5. Date of acquisition
6. Price