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### ► To cite this version:

Louise Carton, Axel Bastien, Nathalie Chérot-Kornobis, Clement Caron, Sylvie Deheul, et al.. An overview of the use of psychoactive substances among students at the University of Lille during the COVID-19 health crisis: Results of the PETRA study.. Dialogues in Clinical Neuroscience, 2023, Dialogues in Clinical Neuroscience, 25, pp.101-111. 10.1080/19585969.2023.2268063 . hal-04355505

**HAL Id: hal-04355505**

**<https://hal.univ-lille.fr/hal-04355505>**

Submitted on 20 Dec 2023


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## An overview of the use of psychoactive substances among students at the University of Lille during the COVID-19 health crisis: Results of the PETRA study

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### ABSTRACT

**Objectives:** Students represent a population at risk for substance abuse. That risk may have been exacerbated by the COVID-19 pandemic. We aimed to describe substance abuse among students and to compare consumption according to the university field.

**Methods:** A self-administered questionnaire was sent by email to all students at the University of Lille, France, between March and July 2021. This anonymous questionnaire included questions about sociodemographic characteristics, university courses and the use of psychoactive substances (frequency, reasons, routes of administration) since the first university year.

**Results:** Among the 4431 students who responded (response rate 6.1%), eighty percent declared having used alcohol since the first university year, 34% cannabis, 15.4% benzodiazepines, 14.7% opioid drugs, 7.5% cocaine, 6.8% nitrous oxide and 6.5% MDMA. More than 20% of the users of cannabis, benzodiazepines, amphetamines and cocaine reported having already felt dependent. Recreational use was described by more than 10% of benzodiazepine or opioid drug users. Nitrous oxide use was significantly more frequent in the health and sport field ( $p < 0.001$ ). Tobacco, benzodiazepine, cannabis and MDMA uses were significantly more frequent in the humanities and social sciences/art, language and literature fields ( $p < 0.001$ ).

**Conclusion:** Prevention measures focusing on alcohol, cannabis, illicit psychostimulants, nitrous oxide and prescription drugs are required in the student population.

### ARTICLE HISTORY

Received 21 December 2022  
Revised 13 June 2023  
Accepted 3 October 2023

### KEYWORDS

Abuse; psychoactive substance consumption; university students


### Introduction

Students represent a population at risk of developing addictive behaviours (Carton et al. 2018; Batisse et al. 2021; Lapeyre-Mestre et al. 2021; Perino et al. 2022). Most of their activity is based on the use of intellectual capacities, with varying requirements depending on the field of study, the period considered and individual factors (Carton et al. 2018). The desire to secure a professional future and the resulting anxiety can thus encourage the use of psychoactive substances (Fond et al. 2016; Carton et al. 2018). In parallel, entry into higher education courses often corresponds to the beginning of a new period of life, marked by a

process of empowerment and generally a greater degree of freedom. New social contacts and integration into student life can therefore provide the basis for psychoactive substance discovery.

Substance misuse in students can lead to many complications, including violent and sometimes fatal effects, disability and failure to meet major responsibilities at work, school or home (Substance Abuse and Mental Health Services Administration 2019). These consequences include immediate physical harm, suicidal behaviour, sleep issues, depression and sex-related harm (Substance Abuse and Mental Health Services Administration 2019). The study of substance

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/19585969.2023.2268063>.

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use among students thus remains a major public health issue to better understand the current trends and to enact adapted prevention action.

In addition to the particularities inherent to this pivotal academic period, the health crisis experienced with COVID-19 may have exacerbated the difficulties encountered by the students. Previous studies highlighted the impact of viral respiratory epidemics in general (Luo et al. 2020) and COVID-19 in particular (Xiong et al. 2020) on mental health in the general population. Anxiety, depression and post-traumatic stress disorder were frequently described (Luo et al. 2020; Xiong et al. 2020). Students may be particularly at risk of mental health issues in this pandemic context (Wang et al. 2020; Xiong et al. 2020; Ren et al. 2021). A nationwide survey dedicated to French students during the COVID-19 quarantine found a high prevalence of self-reported suicidal thoughts and severe self-reported distress, depression, anxiety and stress among the participants (Wathelet et al. 2020). Isolation, fear of illness, uncertainty about the future, disruption of course organisation, and difficulty in following remote courses were all factors that may increase psychoactive substance use.

We thus aimed to describe psychoactive substance use among students in the context of the COVID-19 health crisis. More specifically, this study took place in France during the spring of 2021, more than a year after the beginning of the pandemic, and during the 3rd lockdown of the country. As the use of psychoactive substances can be linked to many factors related to the product, to the individual, and to the environment (Blaise and Rossé 2011), we also evaluated whether there were differences in use between the fields of study.

## Materials and methods

### Study design

These data are from the 'PETRA' study, which is an epidemiological, observational, cross-sectional, analytical, monocentric study conducted among students at the University of Lille, France. This study took place from March to July 2021. A self-questionnaire was sent by email to all students of the University of Lille with 3 reminders.

### Population

The inclusion criteria were as follows: (i) must be a student enrolled at the University of Lille during the 2020–2021 academic year (no fields of study restriction), (ii) non opposition to the study. The noninclusion criterion was being under 18 years of age.

## Questionnaire

An online self-questionnaire hosted by LimeSurvey was sent to the student mailbox.

This anonymous self-questionnaire asked participants about their sociodemographic characteristics: age, sex, type of accommodation, self-assessment of family, financial and friendship situation. The self-assessment evaluations were presented as visual analog scales in which the student was asked to rate himself or herself on the question asked. For the financial self-assessment, the question was 'How would you rate your financial situation?', with 0 corresponding to 'very complicated' and 10 corresponding to 'very comfortable'. For the self-assessment of the family situation, the question was 'How would you evaluate your family situation (quality of support felt)?', 0 corresponding to 'very complicated' and 10 to 'very comfortable'. For the self-assessment of the friendship situation, the question was 'How do you feel surrounded by friends (quality of support felt)?' 0 corresponding to 'very complicated' and 10 to 'very comfortable'.

Concerning educational background the questionnaire asked participants about their course of study, level of study and subjectively perceived level of success. For this self-assessment, the question was 'how do you perceive your level in your higher education'; 0 corresponded to 'feeling of failure', and 10 corresponded to 'complete success'.

Concerning the use of psychoactive substance, the questions concerned the type of substance, the quantification of use, the maximum frequency of use over their life-course and the current period, the route of administration and the reasons for use. Students were also asked if they already had a feeling of dependence on the substance. The different psychoactive substances used by the students were divided into 3 categories: free-access drugs, use of prescription drugs and use of illegal drugs. Notably, cannabis and mushrooms use are illegal in France. Additionally, as amphetamines and methamphetamines on prescription do not have marketing authorisation in France, they have been classified as illegal drugs.

## Statistical analysis

Categorical variables are presented as frequency and percentage: gender, marital status, housing type, income sources, course of study, year of study, type of psychoactive substance consumed, reasons for and frequency of consumption.

Quantitative variables are expressed as the median [IQR]: age, self-assessment of financial, family, and

friendship situations, and self-assessment of the students' level of study.

The study population was divided into 4 groups according to the field of study. We compared the populations using the chi-square test with Pearson correction. A  $p$  value  $<0.05$  indicated a significant difference in proportions or means between the populations. Analyses were performed using R (Team RC 2013) and R Studio software (Team Rs 2020) (<http://www.rstudio.com/>, version 1.1.463).

### Ethics

This is a category 3 noninterventional study according to the french Jardé's law. Each participant has received information before the questionnaire was launched, including the type of study and its objectives. To respect the principle of consent, the students were free to stop the questionnaire at any time. A nonresponse to the questionnaire was considered as opposition, and answering the questionnaire corresponded to a formal consent. The anonymity of the students was warranted both in the collection of data and in their analysis, respecting the MR003 standard of the Commission Nationale de l'Informatique et des Libertés (CNIL).

### Procedures in case of difficulties in completing the questionnaire

The contact details of physicians specialising in psychiatry and/or addictology were given to the students so that they could contact them in case of difficulties encountered during the completion of the questionnaire (feeling of ill-being and/or anxiety, judgement of excessive consumption of psychostimulants or disabling attentional symptomatology).

## Results

### Sociodemographic characteristics

The total sample comprised 4431 students (response rate: 6.1%) (Table 1). The median [IQR] age of the participants was 20 years [19-22], and 74.5% were females. Notably, the students were mostly single (64.2%), living with parents (48.5%) or in personal housing (42.5%), and the main sources of income were parental assistance (48.9%) and/or scholarship (45.1%). The median [IQR] self-assessments regarding family, social and income situation scores were 8 [6-9], 7 [5-8] and 7 [5-9], respectively, with 0 corresponding to 'very complicated' and 10 to 'very comfortable'.

**Table 1.** Sociodemographic and study characteristics of the student participants.

	N = 4431
Age (years)	
Median (IQR)	20 [19–22]
Sex (%)	
Women	74.5
Men	25.5
Familial status (%)	
In a relationship	35.8
Single	64.2
Housing status (%)	
Personal housing (rental and/or shared ownership)	42.5
Lodged by parents/guardians	48.5
University residence	7.9
Other (hostel, homeless, and rent-free)	1.0
Sources of income (%)	
Scholarship	45.1
Student employment	17.2
Paid internships	15.4
Parental assistance	48.9
No income	16.9
Field of study	
Health and sports <sup>a</sup>	28.5
Human and social sciences <sup>b</sup>	38.4
Law, economics and management	16.1
Sciences and technology <sup>c</sup>	17.1
Year of study (%)	
1	38.4
2	21.1
3	16.1
4	10.0
5	9.5
6 or more	5.1
Self-assessment regarding (median, IQR)	
Family situation	8 [6–9]
Social situation	7 [5–8]
Income situation	7 [5–9]
Academic situation	6 [4–7]

<sup>a</sup>Includes Health + Science and techniques of physical and sports activities fields.

<sup>b</sup>Includes Human and Social Sciences + art, literature and language fields.

<sup>c</sup>Includes Sciences and Technology + University Institutes of Technology fields.

### Studies characteristics

The most represented fields of study were human and social sciences (38.4% of the responders), followed by health and sports (28.5%), sciences and technology (17.1%) and law, economics and management (16.1%) (Table 1). Approximately 3 quarters of the students were pursuing a bachelor degree, with one third in their first year of study. The median [IQR] self-assessment score regarding academic situation was 6 [4-7] (Table 1).

To compare the characteristics of our sample with those of the source population, the characteristics of all students enrolled at the University of Lille (sex, field and year of study) are presented in the [Supplemental Data](#).

### Use of psychoactive substances

#### Free-access psychoactive substances

Since their first year at the university, 80.0% of the responders had used alcohol, with 12.6% of them

**Table 2.** Patterns of substance use among students.

	Use since first entering university (%)	Ever felt addicted <sup>a</sup> (%)	Current frequency of consumption <sup>a</sup> (%)			
			1. Less than once a month	2. Once a month	3. Once a week	4. Every day or almost every day
Free-access psychoactive substances						
Alcohol	80.0	12.6	37.2	21.8	34.5	6.6
Tobacco <sup>b</sup>	40.3	52.4	NA <sup>b</sup>			
Nitrous oxide	6.8	3.0	98.4	1.0	0.7	0.0
Sulbutiamine	0.6	7.1	75	0.0	3.6	21.4
Use of prescription drugs						
Benzodiazepines	15.4	34.1	57.7	12.0	10.7	19.6
Opioids	14.7	18.6	82.6	7.5	4.6	5.2
Corticoids	8.5	6.3	81.3	4.2	3.4	11.1
Beta-blockers	3.1	14.0	56.6	7.3	2.9	33.1
Methylphenidate	0.7	33.3	40.0	6.7	10.0	43.3
Modafinil	0.4	18.8	37.5	12.5	25.0	25.0
Piracetam	0.2	11.1	44.4	33.3	0.0	22.2
Use of illegal drugs						
Amphetamine and/or methamphetamines prescription drugs	2.1	30.0	58.9	16.7	8.9	10.0
Cannabis	34.0	23.8	69.8	9.1	6.4	10.0
Cocaine	7.5	23.0	86.8	9.8	2.9	0.6
MDMA	6.5	12.8	91.7	6.6	1.7	0.0
Amphetamines	5.7	20.5	72.8	8.3	4.3	14.6
Mushrooms	4.0	1.1	98.3	1.1	0.6	0.0
LSD	2.4	4.0	97.0	3.0	0.0	0.0
Methamphetamine	1.5	19.4	90	6.0	0.0	4.5
NPS	0.9	17.1	75.6	12.2	4.9	7.3
GHB	0.8	11.8	91.2	5.9	2.9	0.0
Heroin	0.2	50	100	0.0	0.0	0.0

<sup>a</sup>Among students who have used the substance since first entering university.

<sup>b</sup>Current frequency of tobacco use in different categories, with 48.3% of the students reporting smoking less than once per month, 6.9% once per month, 10.8% once per week, 26.3% 1–10 cigarettes/day, 6.6% 11–20 cigarettes/day, and 1.1% more than 20 cigarettes per day.

GHB: gamma-hydroxybutyric acid; LSD: lysergic acid diethylamide; MDMA: 3,4-methylenedioxyamphetamine; NPS: new psychoactive substances

reporting having already felt dependent on this substance and with a regular current frequency of consumption (Tables 2–4). As expected, alcohol was mainly used for recreational effects.

Tobacco was also highly prevalent, with 40.3% of the students describing its use since first entering university and 52.4% of them reporting having already felt dependent. Interestingly, 20.0% of responders reported uses to help with concentration and 5.0% to balance the effect of other drugs during the drug break.

Nitrous oxide consumption was not anecdotal and concerned 6.8% of the students, with 3.0% of them having already felt dependent. However, consumption was more occasional (98.4% of responders reported use less than once a month). The most frequently reported reasons for use were recreational effect (86.1%) and experimentation (34.0%).

### Use of prescription drugs

The most frequent prescription drugs used were benzodiazepines (15.4%), opioids (14.7%) and corticoids (8.5%) (Tables 2–4). Notably, one-third of benzodiazepines and approximately 20.0% of opioid users already felt dependent on the substance. Additionally, 10.0%

of benzodiazepine and prescription opioid users were searching for a recreational effect.

The use of psychostimulant prescription drugs (methylphenidate and modafinil) was rarer, but feeling of addiction was prevalent. As expected, the main reasons for use were to help with concentration and to improve alertness and wakefulness. Some students also reported use for weight loss, improvement of physical abilities, experimentation (testing new psychoactive drugs), recreational effects and balancing the effect of other drugs during the drug break. Except for methylphenidate, which was only used orally, the routes of administration for modafinil included the injected, snorted and inhaled routes. The use of piracetam was rarely reported (0.2%). The main reasons for use stated by students were help with concentration and experimentation, with some of them reporting the use of the smoked, injected and snorted routes of administration.

### Use of illegal drugs

The most frequent illegal drugs used were cannabis (34.0%), cocaine (7.5%), MDMA (6.5%) and amphetamines (5.7%) (Tables 2–4). Nearly a quarter of cannabis and cocaine users already felt dependent, and 20.0% of amphetamine users already felt dependent. Regarding

**Table 3.** Reason for use.

Reason for use*	1 (%)	2 (%)	3 (%)	4 (%)	5 (%)	6 (%)	7 (%)	8 (%)	9 (%)	10 (%)
Free-access psychoactive substances										
Alcohol	0.9	0.5	81.9	1.6	0.2	1.6	0.2	9.2	0.0	20.2
Tobacco	19.2	9.1	52.3	5.2	0.0	0.1	6.4	19.1	0.2	27.7
Nitrous oxide	0.3	0.7	86.1	3.0	0.0	0.3	0.0	34.0	1.0	2.3
Sulbutiamine	85.7	46.4	0.0	0.0	3.6	0.0	0.0	10.7	17.9	14.3
Use of prescription drugs										
Benzodiazepines	6.7	1.9	10.3	2.5	0.4	0.2	0.9	2.9	78.3	17.0
Opioids	2.3	2.2	11.7	0.8	0.9	0.3	0.9	4.2	74.0	9.7
Corticoids	2.90	2.90	0.8	0.0	0.8	0.0	0.0	0.5	91.8	5.8
Beta-blockers	8.8	1.5	3.7	0.0	0.0	0.0	0.0	0.7	88.2	14.7
Methylphenidate	56.7	43.3	3.3	3.3	10.0	0.0	10.0	3.3	66.7	6.7
Modafinil	75.0	87.5	6.3	6.3	6.3	0.0	18.8	31.3	31.3	0.0
Piracetam	33.0	0.0	0.0	0.0	0.0	0.0	0.0	22.2	0.0	44.4
Use of illegal drugs										
Amphetamine and methamphetamines prescription drugs	8.9	2.2	10.0	0.0	2.2	0.0	0.0	3.3	28.9	38.9
Cannabis	7.3	3.1	86.6	6.3	0.6	3.1	2.8	26.0	2.9	9.2
Cocaine	17.8	33.3	85.1	14.9	3.5	8.1	2.9	41.4	0.0	1.7
MDMA	2.4	10.0	92.7	6.2	1.7	7.3	2.1	37.4	0.0	1.7
Amphetamines	9.1	15.4	70.5	7.5	1.2	6.3	3.5	30.3	18.1	4.7
Mushrooms	1.1	4.5	88.7	2.8	0.0	0.0	0.0	52.0	0.6	1.1
LSD	4.0	12.0	84.2	3.0	0	4.0	2.0	66.3	2.0	5.0
Methamphetamines	11.9	26.9	82.1	10.5	0.0	9.0	6.0	41.8	0.0	4.5
NPS	14.6	26.8	65.9	12.20	4.9	17.1	7.3	61.0	2.4	2.4
GHB	5.9	8.2	44.1	5.9	0	32.4	0	38.2	2.9	33.3
Heroin	12.5	12.5	62.5	37.5	12.5	12.5	12.5	25.0	12.5	25.0

\*The students could report multiple reasons for use for a given substance

- 1: Helps with concentration
- 2: Improves alertness and wakefulness
- 3: Search for a recreational effect (exhilaration, euphoria, and fun)
- 4: Balances the effect of other drugs during the drug break
- 5: Improvement of physical abilities (muscle mass gain)
- 6: Improvement of sexual abilities
- 7: Weight loss
- 8: Experimentation (testing new psychoactive drugs)
- 9: Medical treatment
- 10: Others

GHB: gamma-hydroxybutyric acid; LSD: lysergic acid diethylamide; MDMA: 3,4-methylenedioxyamphetamine; NPS: new psychoactive substances.

**Table 4.** Routes of administration of the various psychoactive substances used\*.

Routes of administration	Oral (%)	Smoked (%)	Injected (%)	Snorted (%)	Inhaled (%)	Others (%)
Free-access psychoactive substances						
Sulbutiamine	100	0.0	0.0	0.0	0.0	0.0
Use of prescription drugs***						
Benzodiazepines	100	0.2	0.7	0.9	0.0	0.0
Opioids	98.5	0.9	3.4	1.2	0.0	0.0
Corticoids	82.6	0.3	2.6	0.5	7.9	0.0
Beta-blockers	99.3	0.0	0.7	0.0	0.0	0.7
Methylphenidate	100	0.0	0.0	0.0	0.0	0.0
Modafinil	87.5	0.0	6.3	6.3	12.5	0.0
Piracetam	100	11.1	11.1	11.1	0.0	0.0
Use of illegal drugs						
Amphetamine and methamphetamines prescription drugs	91.1	6.7	1.1	12.2	2.2	0.0
Cannabis	20.3	93.9	0.0	0.4	11.8	1.1
Cocaine	7.5	12.6	1.2	96.7	0.0	0.0
MDMA	98.3	1.4	0.7	22.2	0.7	0.0
Amphetamines	85	6.7	1.6	40.2	2.8	1.2
Mushrooms	98.9	2.3	0.0	0.0	0.6	2.3
LSD	100	0.0	0.0	0.0	0.0	0.0
Methamphetamine	34.3	11.9	1.5	76.1	1.5	0.0
NPS	48.8	9.8	7.3	58.5	4.9	7.3
GHB	85.3	8.8	0.0	0.0	8.8	2.9
Heroin	0.0	50.0	50.0	37.5	12.5	0.0

\*The students could report multiple routes of administration for a given substance. The routes of administration of alcohol, tobacco, and nitrous oxide were not explored in this study because for the most part, they were taken orally, smoked or inhaled, respectively.

\*\*\*Note that some prescription drugs exist in different routes of administration in medical use: (i) oral, inhaled or injectable for corticoids; (ii) oral and injectable for opioid-based drugs, beta-blockers and some benzodiazepines; (iii) oral only for methylphenidate, modafinil and piracetam.

GHB: gamma-hydroxybutyric acid; LSD: lysergic acid diethylamide; MDMA: 3,4-methylenedioxyamphetamine; NPS: new psychoactive substances

the current frequency of consumption, 14.6% of amphetamines and 10.0% of cannabis users reported using these drugs every day or almost every day. Cannabis was frequently used not only for recreational effects (86.6%) and experimentation (testing new psychoactive substances) (26.0%) but also for help with concentration (7.3%) and to balance the effect of other drugs during the drug break (6.3%). In addition to recreational and experimental use, cocaine and amphetamines were also frequently used to improve alertness/wakefulness (33.3% for cocaine and 15.4% for amphetamines) and for concentration purposes (17.8% for cocaine and 9.1% for amphetamine). The use of mushrooms or LSD since first entering university was reported by 4% and 2.4% of students, respectively. The consumption appears to be very occasional and mainly linked to the search for a recreational effect and experimentation. Finally, less than 1% of students reported using GHB, NPS or heroin, with 50% of heroin users having already experienced a feeling of dependence.

### **Use of psychoactive substances according to the field of study**

The use of certain psychoactive substances differed significantly by study field (Table 5). Nitrous oxide consumption since the first year of university, for example, had a greater use in students in the health and sport field of study ( $p < 0.001$ ). Conversely, tobacco ( $p < 0.001$ ), sulbutiamine ( $p = 0.02$ ), benzodiazepines ( $p < 0.001$ ), beta-blockers ( $p = 0.03$ ), amphetamines and methamphetamines prescription drugs ( $p < 0.001$ ), cannabis ( $p < 0.001$ ), cocaine ( $p = 0.04$ ), MDMA ( $p < 0.001$ ), amphetamines ( $p = 0.01$ ), mushrooms ( $p = 0.01$ ), methamphetamines ( $p = 0.04$ ), and LSD ( $p = 0.03$ ) were significantly used more in students in the human and social sciences fields since the first year of university. Heroin was also more significantly used in students in the sciences and technology fields since the first year of university ( $p = 0.04$ ).

### **Discussion**

Our main results could be summarised as follows: (i) alcohol (80%), tobacco (40.3%) and cannabis (34.0%) were the substances most frequently used by students since their first year of university, but prescription drugs, especially benzodiazepines (15.4%) and opioid-based drugs (14.7%), were also frequently used; (ii) having already felt dependent was reported by one-third of the students who had used benzodiazepines and methylphenidate, nearly one-quarter of cannabis

and cocaine users, approximately 20% of those who had used the opioid-based drugs, modafinil and amphetamines, and by more than 10% of alcohol users; (iii) the reason for use varied depending on the substance considered, with the most common being recreational use; (iv) the lowest score on the self-assessment scales was for the academic situation in comparison with family, social and income situations; and (v) the prevalence of use of certain psychoactive substances varied according to the field of study, with the humanities and social sciences fields representing a risk group for several of the substances evaluated, while students in the health and sport field were the most at risk for nitrous oxide use.

Concerning free-access psychoactive substances, the high prevalence of alcohol and tobacco use is consistent with literature data (Tavolacci et al. 2013; Batisse et al. 2021; Perino et al. 2022). The fact that more than half of the students reported having experienced a feeling of dependence to tobacco is not surprising given the high addictive potential of nicotine (Nutt et al. 2007). However, these data, along with the fact that over 10% of students reported having already felt dependent to alcohol, are worrisome in this young population given the high propensity for these substances to cause illness and death as a result of chronic use (Nutt et al. 2007). We found that 6.8% of the respondents reported nitrous oxide use since first entering university. Even if only a few described already feeling dependent or having a regular frequency of consumption, nitrous oxide use is still a source of concern. This substance, also called a laughing gas, for a long time has been considered as harmless. Importantly, its use for non-medical purposes has recently increased, raising concerns about risk of accidents, addiction and neurological adverse effects (Fidalgo et al. 2019; Lapeyre-Mestre et al. 2020; Micallef et al. 2021; Largeau et al. 2022). More recently, cases published in the literature have linked the recreational use of nitrous oxide with the occurrence of various thrombotic complications (Oulkadi et al. 2022). Thus, the monitoring of this phenomenon, particularly by addictovigilance systems, remains essential (Lapeyre-Mestre et al. 2020). Although sulbutiamine use was described by few students, 7% of users reported a sense of dependence, highlighting the importance of monitoring the risk of over-the-counter medications. To our knowledge, only few data exist in the literature concerning the risk of misuse and dependence on sulbutiamine (Douzenis et al. 2006).

Concerning the use of prescription drugs, benzodiazepine and opioid drug use were frequently reported

**Table 5.** Substance use since first entering university according to the field of study.

	Health and sport (%)	Human and social sciences (%)	Law, economics and management (%)	Sciences and technology (%)	Q obs (Pearson)	<i>p</i>
Free-access psychoactive substances						
Alcohol	79.1	81.1	80.9	78.0	4.1	0.25
Tobacco	33.5	45.5	43.3	37.4	48.1	<b>&lt;0.001</b>
Nitrous oxide	11.3	4.9	5.2	5.3	54.3	<b>&lt;0.001</b>
Sulbutiamine	1.1	0.2	0.8	0.5	9.5	<b>0.02</b>
Use of prescription drugs						
Benzodiazepines	13.3	19.7	12.4	12.3	38.4	<b>&lt;0.001</b>
Opioids	13.1	16.4	14.4	14.0	6.7	0.08
Corticoids	9.3	8.7	8.2	7.5	2.1	0.56
Beta-blockers	3.3	3.8	1.7	2.4	8.86	<b>0.03</b>
Methylphenidate	0.5	0.8	0.6	0.9	1.8	0.62
Modafinil	0.6	0.2	0.4	0.5	3.6	0.31
Piracetam	0.1	0.1	0.1	0.0	3.6	0.31
Use of illegal drugs						
Amphetamines and methamphetamines prescription drugs	0.3	0.9	0.3	0.4	223.7	<b>&lt;0.001</b>
Cannabis	28.6	38.5	34.4	32.9	31.7	<b>&lt;0.001</b>
Cocaine	3.4	4.7	4.6	2.5	8.3	<b>0.04</b>
MDMA	4.9	8.4	4.8	6.6	18.8	<b>&lt;0.001</b>
Amphetamines	4.3	7.1	5.5	5.3	11.3	<b>0.01</b>
Mushrooms	3.6	5.1	2.4	3.6	11.1	<b>0.01</b>
LSD	1.6	3.1	1.8	2.0	9.1	<b>0.03</b>
Methamphetamine	1.0	2.2	1.3	1.1	8.3	<b>0.04</b>
NPS	0.7	1.3	1.0	0.4	5.5	0.14
GHB	0.9	0.7	0.7	0.9	0.8	0.85
Heroin	0.0	0.1	0.3	0.5	8.1	<b>0.04</b>

GHB: gamma-hydroxybutyric acid; LSD: lysergic acid diethylamide; MDMA: 3,4-methylenedioxyamphetamine; NPS: new psychoactive substances. Significant *p*-values ( $p < 0.05$ ) are highlighted in bold.

by the respondents, which is consistent with previous studies (Batisse et al. 2021; Perino et al. 2022). The fact that more than one-third of benzodiazepine users reported having already felt dependent and that 20% described a consumption rate of every day or almost every day is particularly of concern. Indeed, France is one of the largest consumers of benzodiazepines in the world, and their chronic use could lead to undesirable effects such as deleterious impact on learning outcomes in addition to substance use disorders, drowsiness, falls or hypotension (Bonney et al. 2021). In our study, the reasons for use were mostly medical treatment (78.3%), other (17.0%), search for a recreational effect (10.3%) and help with concentration (6.7%). The fact that the main reason for use was for medical treatment indicates a significant level of anxiety. This anxiety requiring drug treatment could be related to several factors, including the sanitary context. Indeed, it should be mentioned that this survey took place in the spring of 2021, approximately one year after the beginning of the pandemic. However, we do not have comparative data to assess more precisely the role of the health crisis in the challenges faced by students. These results, in addition to those of the lowest score on the self-assessment scales for the studies situation, seriously question the well-being of students in their academic careers. In addition, students are not always aware of the adverse effects associated with the treatments taken.

Here, the risk of short-term memory impairment with benzodiazepines could have an additional deleterious impact on studies. The question of pharmacological management of an identified anxiety must therefore be based on an optimal evaluation of the benefit/risk balance.

A feeling of dependence was also frequently reported by opioid prescription drug users, but the frequency of use was more occasional. However, although the main reason for use was drug treatment, over 10% of users reported recreational use. Furthermore, opioid prescription treatment can also be accompanied by prescription opioid misuse. In a previous study conducted in adults with chronic non-cancer pain, the motivations cited for prescription opioid misuse, apart from pain relief, were to calm down, relax and improve mood (Kerckhove et al. 2022). Prescription opioid misuse was shown to be related to the male sex, young age, the presence of nociplastic pain of severe intensity, codeine use and coprescription of benzodiazepines (Kerckhove et al. 2022). Among other complications (Biancuzzi et al. 2022), prescription opioid misuse may lead to increased suicidality (Ashrafioun et al. 2019), and intervention at this level is also essential.

Unlike benzodiazepine and opioid prescription use, methylphenidate and modafinil uses were much less reported by students. Prevalence use was similar to that found in previous French studies (Fond et al.



2016) but much less important than that found in some other countries (Agence Nationale de Sécurité des Médicaments et des Produits de Santé., 2007). This could clearly be related to the strong restrictions on the prescription and delivery of methylphenidate and modafinil in France (Agence Nationale de Sécurité des Médicaments et des Produits de Santé., 2022a; Agence Nationale de Sécurité des Médicaments et des Produits de Santé., 2022b). Only two-thirds of responders described methylphenidate as a medical treatment. The other most frequently reported reasons were improved concentration, alertness and wakefulness. This could be related to addressing undiagnosed or subthreshold ADHD (Hartung et al. 2013) but also, as previously hypothesised, to reinforcing alertness in social situations and therefore facilitating prolonged social engagement (Rabiner et al. 2009). Even if the potential of abuse of methylphenidate has already been described and discussed (Pauly et al. 2019), the fact that more than a third of the users reported having already felt a sense of dependence could also reflect the need to consume a drug treatment to alleviate symptoms rather than represent misuse itself. Indeed, methylphenidate is a pharmacological treatment of adult ADHD (Weibel et al. 2020) that can be taken every day and especially on days when the person needs to concentrate. Interestingly, unlike methylphenidate, which was taken orally by all respondents, cases of misuse of modafinil were described, with intake by injection, sniffing or inhalation. Although piracetam is officially recognised as a nootropic drug (Sharif et al. 2021), with prescribing conditions not as restricted as those for methylphenidate or modafinil, its use was rarely reported by students. It could be linked to the fact that the enhancing effects in the healthy individual's brain has been described as moderate (Sharif et al. 2021). However, its potential for misuse was highlighted in our study, with several students describing a use for experimentation and a use by smoking, injecting or snorting.

Concerning the use of illegal drugs, the high prevalence of cannabis misuse in the student population is consistent with previous studies (Batisse et al. 2021; Perino et al. 2022). Associated with the fact that a quarter of students described having experienced a feeling of dependence and 10% report daily consumption is worrisome given the risk of psychiatric and cardiovascular complications (Jouanjus et al. 2017; Gukasyan and Strain 2020). The prevalence of illicit psychostimulants like cocaine, amphetamine, and MDMA, was similar or slightly higher than in previous French studies (Fond et al. 2016; Batisse et al. 2021;

Perino et al. 2022), but lower than in countries like the United States of America (13%) (Kasperski et al. 2011) and higher than in countries like the Netherlands (1.3%) (Schelle et al. 2015). Notably, in our study, approximately 20% of cocaine and amphetamines users described having experienced a feeling of dependence. Although use for experimental or recreational purposes was most frequently reported, uses to improve concentration, alertness and vigilance were also frequently described, which raises the question of cognitive doping (Hiltdt et al. 2015). The fact that improvement of sexual abilities was also described as a reason to consume cocaine, amphetamine or methamphetamine raises the issue of chemsex, i.e., the use of psychoactive substance to initiate, facilitate, improve and prolong sexual experiences, which has been described as highly prevalent in students in a recent study (Malandain et al. 2021). Improving sexual performance was also a reported reason for using NPS, heroin and LSD, with injectable routes used for NPS and heroin, suggesting slamming practices. Slamming consists of injecting psychostimulants (including NPS) intravenously to increase sexual performance. Although the use of these substances was not frequently reported, chemsex practices expose students to complications such as substance use disorders, acute neurological or cardiovascular intoxications, various psychiatric disorders, and viral and bacterial infections (Malandain et al. 2021; Batisse et al. 2022). Finally, it's worth noting that although heroin was the substance least reported by students, it seemed to be the most addictive after tobacco.

Interestingly, we found that substance use since first entering university differed according to the field of the study. The fact that nitrous oxide use was more frequent in students in the health and sport field is consistent with the historical use of this substance in medical settings. However, it also shows that the toxicity of the product remains underestimated in a population normally more experienced in the evaluation of drug adverse effects. The fact that students in the social sciences field (including human and social sciences + art, literature and language) represent in our study a risk group for several of the substances evaluated also makes it a particular target for prevention.

We should acknowledge several limitations to this study. First, the response rate was 6.1%, which may have led to a selection bias. Second, the monocentric character limits its extrapolation. Third, although the predominantly female sex ratio of study respondents was consistent with the sex ratio of all students

enrolled at the university (61%, see [Supplemental Data](#)) (Université de Lille 2021), this may have led to a biased estimation of substance use, as substance use disorders affect women and men differently (Fonseca et al. 2021). This overrepresentation of women is not surprising as previous studies have found that women were more likely to participate in scientific studies than men (Galea and Tracy 2007; Wathelet et al. 2020). Fourth, given that the study is based on a self-questionnaire, information and participation biases cannot be excluded and may have led to an over- or underestimation of the reported consumption. At last, as this cross-sectional study was the first one conducted in this population, we do not have data allowing us to compare the use of psychoactive substances before and after the health crisis.

Our study allowed us to take a picture of psychotropic drug use in a student population, underlining the importance of the addictive problem in this population and the interest in targeted prevention measures according to the substance and the field of study. More specifically, prevention measures should focus on alcohol, cannabis, illicit psychostimulant drugs, nitrous oxide, and prescription drugs (benzodiazepines, opioids) use among university students. An extension of this study to other centres is planned to increase the power and to establish comparative analyses between universities. It is a tool that will allow to follow the consumption of substances according to the general and sociological contexts but also to evaluate the impact of prevention and support policies on the consumption of psychoactive substances.

## Disclosure statement

OC: speaker or chairman at industry symposia (Janssen, Recordati, Indivior). The other authors have no competing interest to disclose.

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