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Behavioural patterns and dangers: a mixed-methods exploration of simultaneous polysubstance use and intervention strategies among Swiss adolescents

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Summary

BACKGROUND: Recent trends in Switzerland indicate a concerning rise in simultaneous polysubstance use among adolescents, a practice marked by the concurrent or sequential consumption of multiple psychoactive substances, notably alcohol and cannabis, alongside prescription medications (e.g. benzodiazepines) and illicit drugs, resulting in dozens of fatal outcomes. However, data on simultaneous polysubstance use and evidence-based approaches to effective prevention is lacking.

AIMS OF THE STUDY: The study aimed to explore and gain insights into use patterns, use settings, use motives, harm-reduction strategies, concerns associated with substance use, and support and counselling services from the point of view of adolescents practicing simultaneous polysubstance use in Switzerland.

METHODS: An exploratory study was conducted via an online survey (n = 116) and two focus group discussions with affected Swiss adolescents aged 14 to 20. A mixed-methods approach was applied to gain insights and better understand the phenomenon of simultaneous polysubstance use among Swiss adolescents. Quantitative survey data obtained between November 2021 and March 2023 by means of convenience sampling – organised by distributing flyers (in three national languages) among several project partners, on the internet, over social media and by word of mouth – was analysed descriptively, whereas qualitative survey data and focus group data were thematically explored. A concurrent nested design was employed, utilising quantitative findings as a core foundation for addressing research questions, while qualitative findings were instrumental in validating and providing contextual depth to the results.

RESULTS: Our findings reveal a preference of the sample for combining alcohol with cannabis and/or other substances (e.g. benzodiazepines or hard drugs) in social settings, driven by diverse motives, including enhancement of experiences and partly maladaptive coping mechanisms leading to self-medication. Despite some awareness of the potential harms, there is a significant reliance on peer-shared strategies for harm reduction, highlighting a gap in formal support and counselling services, some of which are perceived by adolescents as lacking empathy and relevance.

CONCLUSIONS: This study underscores the urgency of developing targeted, youth-centred interventions that resonate with the lived realities of adolescents, aiming not only to reduce substance use but also to address the broader psychosocial factors contributing to simultaneous polysubstance use. By shedding light on the complex dynamics of adolescent polysubstance use, our research contributes to the ongoing dialogue on effective prevention strategies, advocating for a holistic approach encompassing education, policy reform and community support to tackle this multifaceted public health challenge.

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Introduction

Simultaneous polysubstance use, which involves using multiple substances simultaneously or concurrently (closely in time, e.g. within several hours or one evening), is not a new phenomenon. However, the research interest in this topic has increased over the last few years. Compared to the late 2000s and early 2010s, the number of publications on PubMed referring to “polysubstance use” in the last two years has increased 6-fold, from around 50 to about 300 a year. At the same time, the number of publications referring to “polysubstance abuse” increased from approximately 40 to over 200. However, this outcome also underlines the substance consumption trends.

Already a decade ago, there were studies reporting an increasing number of combined consumption of two or more psychoactive substances [1]. One reason might be that some substances diverted from legal sources – especially, considering the increase in medication prescriptions over

the past few decades, prescription drugs (e.g. opioids, stimulants, sleeping and sedative/anxiety medications) – are sometimes used for non-medical purposes [2–13]. For example, benzodiazepines have been reported to be a persistent misused medical drug, especially in combination with alcohol [14]. This holds true not only for adults but for adolescents as well. There is strong evidence that a substantial number of young people (up to 8%) misuse prescribed drugs such as benzodiazepines for non-medical purposes [15–22].

However, not only the rate of prescription drug misuse is alarming, but the simultaneous use of several substances where one of them is a prescription drug. Certain reviews identified the lack of research on prescription drug misuse, especially in the context of simultaneous polysubstance use [23]; there is however sufficient empirical evidence to show that the simultaneous polysubstance abuse of, for instance, benzodiazepines seems to have reached an epidemic level and is common in combination with opioids and alcohol [24]. According to the WHO's most recent global status report on alcohol and health, "the use of several psychoactive substances is more the rule than an exception" [25].

Nevertheless, most studies thus far have focused on adults [2, 26, 27]. Furthermore, the majority of published studies are about simultaneous polysubstance use in individuals with opioid use disorder or are strongly related to polysubstance use in combination with opioid use (e.g. related to the US opioid crisis) [28–32].

Studies on the prevalence of simultaneous polysubstance use among youth are rare, and the reported rates vary enormously between different studies and combined substances: A large Canadian study among 51,767 secondary school pupils identified 11% of the participating females and 15% of the participating males as simultaneous polysubstance users [33]. Another recent study from Norway with 97,429 13–18-year-old adolescents reported lower rates of around 2%. However, co-consumption involving alcohol or nicotine products was not considered mixed consumption in this study [34]. Other studies also highlight that the rate of simultaneous polysubstance use varies among the combinations [35–39].

Despite the lack of research, there is evidence that adolescents from vulnerable populations (e.g. low socioeconomic status, nontraditional gender identification or sexual orientation, presence of mental health disorders) show higher rates of polysubstance use in comparison to other adolescents [33, 34, 39–49].

The simultaneous use of multiple drugs heightens the potential for various drug-related dangers. Certain drug combinations – like mixing benzodiazepines or cocaine with alcohol – can amplify various health hazards (respiratory, cardiac, neurological, cognitive, psychological, etc). For example, the combination of cocaine and alcohol can lead to the formation of cocaethylene, a potent and long-lasting psychoactive metabolite that can exacerbate the toxic effects of both substances [50]. This combination has been associated with an increased risk of neurological and cardiac emergencies, including stroke and cardiac arrhythmias [51]. Notably, using multiple depressant substances together, including opioids, benzodiazepines and alcohol, significantly elevates the likelihood of both lethal and non-lethal overdoses [21, 52–59]. Studies from the US showed that there is a significant correlation between simultaneous polysubstance use and overdose mortality [60, 61]. Additionally, there are relationships between simultaneous polysubstance use in adolescents and the adverse outcomes on their later psychosocial state and their financial, educational and criminal history (e.g. as a result of not completing high school) [62–64].

However, it must be mentioned that although different simultaneous polysubstance use patterns exist, previous research has usually described three to four types: (1) tobacco/nicotine and alcohol; (2) alcohol and marijuana (cannabis); (3) alcohol/pain medication/inhalant; and (4) polysubstance use, i.e. using substances concurrently or sequentially beyond the common pairings identified; this category encompasses a more complex pattern of substance use that includes various combinations of alcohol, prescription medications, illicit drugs including heavy drugs, and other psychoactive substances, highlighting a broader and more diverse range of substance use behaviours [34, 36–39, 58, 65–68]. Additionally, certain studies have differentiated according to the number and amount of concurrent substances used [47].

Situation in Switzerland

In Switzerland, the concerning impact of simultaneous polysubstance use on adolescent mortality has become apparent. In the last five years, media reports have sounded the alarm, pointing to increasingly visible cases of highly problematic mixed use of harder drugs, medications (especially benzodiazepines) and alcohol among adolescents, as well as corresponding trade involving adolescents, including at schools [69–76]. Investigations conducted by Swiss media reveal a troubling pattern: since 2018, dozens of adolescents have tragically lost their lives due to simultaneous polysubstance use [77]. These fatalities are thought to arise from the combined effects of different drugs or the simultaneous use of psychoactive substances with alcohol. Notably, substances like benzodiazepines, as well as cough medicines containing codeine, various opioid-based medications and occasionally illicit substances, have emerged as primary contributing factors [77].

Even though research focusing on simultaneous polysubstance use is rare in Switzerland, the evidence is undeniable that it is becoming a serious public health concern in Switzerland [78]. A recent survey conducted on a cohort of 1180 individuals in Switzerland revealed that over one-third of individuals aged 20 reported engaging in simultaneous polysubstance use involving illicit substances, non-medical use of prescription drugs, and cannabidiol [79]. However, this study was a cohort study limited to one city. Another survey among people practicing simultaneous polysubstance use, aged 11 years and older, identified alcohol as the most used substance (e.g. with cannabis, MDMA [3,4-methylendioxy-N-methylamphetamin, "ecstasy"], amphetamine, cocaine, benzodiazepines, etc.) [80]. However, the majority of the 324 participants were of legal age. The latest survey results among almost 1200 adolescents in the Canton of Schwyz showed that, despite several limitations and the fact that the reported rates were relatively low, around 1% of interviewees were nevertheless involved in high-risk simultaneous polysubstance use

[81]. Another recent research on polydrug use among 14- and 15-year-old adolescents from pupil surveys conducted in a school setting (the Health Behaviour in School-aged Children [HBSC] study) showed that depending on the combination and the age and sex subgroup, up to 10% of respondents reported simultaneous polysubstance use experiences [82]. The current situation is particularly concerning because the figures clearly indicate that consumption of medicinal products in Switzerland has been steadily increasing over the past years. Thus, half the population uses a medication weekly, with a quarter of the overall population using a painkiller weekly. At the same time, figures are rising for the consumption of hard drugs (e.g. heroin, cocaine, ecstasy, speed, etc), especially among young people, where the proportion has increased from 1% to 3% over 20 years [83]. Moreover, there is currently a lack of reliable data on the potentially new and hazardous combination of alcohol with psychoactive prescription drugs. Addiction specialists and professionals in the field are concerned about an increase in this type of simultaneous polysubstance use. Furthermore, established concepts and systematic approaches for effective prevention or intervention in this area are lacking [84].

In sum, simultaneous polysubstance use is a reality for some adolescents in Switzerland. At the same time, very little is known about adolescent users in Switzerland, their motives, patterns of use and problem burden (among other reasons, due to the focus on adults and/or the heterogeneity of users) [77].

Aim of the present study

Given that information regarding simultaneous polysubstance use among Swiss adolescents is very rare, the study aimed to explore the phenomenon and to gain insights into (a) use patterns, (b) use setting (e.g. where and with whom the target population practices polysubstance use), (c) use motives (e.g. why the target population practices polysubstance use), (d) harm-reduction strategies (e.g. about the knowledge and use of harm-reduction strategies in the context of simultaneous polysubstance use), (e) concerns associated with substance use, and (f) support and counselling services (and the expectations about them). Specific research questions were determined in relation to these research aims.

Materials and methods

Given the lack of research on simultaneous polysubstance use among Swiss adolescents, a mixed-method design – concurrent nested design [85–89] – was used to thoroughly examine a group of Swiss teenagers aged 14 to 20 who frequently engage in simultaneous polysubstance use. Both quantitative and qualitative data were gathered concurrently, but the qualitative approach was integrated into the primary quantitative method. This approach provides a more comprehensive understanding of the target population, surpassing the limitations of the predominant quantitative method.

For better understanding, the quantitative (survey) and qualitative (focus group discussion [FGD]) methods are reported separately.

Sample

Survey sample

Adolescents involved in simultaneous polysubstance use are a hard-to-reach population due to several factors such as stigmatisation and fear of consequences from parents and authorities. In the survey conducted by Rieder [80] related to simultaneous polysubstance use in Switzerland, only 110 people were between 14 and 20. Given this result, we used it as an anchor aiming to reach a comparable number of interviewees. Also, given the results of previous research and publications in the media showing simultaneous polysubstance use among adolescents, we aimed to reach people from 14 years of age.

Focus group discussion sample

We aimed to conduct two focus group discussions with simultaneous polysubstance users in the survey who were willing to participate in an focus group discussion and share their thoughts and experiences about polysubstance use. Next, to have experience with simultaneous polysubstance use, the interviewees must be between 14 and 20 years old. Additionally, the participation in focus group discussions was restricted to (Swiss)-German speakers.

Questionnaires

Survey

The research team developed a questionnaire in several iterative steps to gather the necessary information. It was checked several times by five people aged 16–18 years (3 consumers vs 2 non-consumers using an iterative approach to integrate the inputs) who were not involved in the study later.

The questionnaire comprised comprehensive information about the study, encompassing its objectives, participation requirements, the organisation conducting the research, the potential benefits of participation, the voluntary nature of involvement, privacy assurances, details regarding the ethics committee oversight, and any possible inconveniences. Additionally, the introduction featured emergency contact numbers and resources related to information and counselling services that could be pertinent to the target population. In addition to obtaining informed consent, inclusion criteria (aged 14 to 20 years; a regular history of simultaneous polysubstance use; Swiss residence) for progressing to the main sections of the survey were programmed as filter questions.

In the survey's main section, participants were first questioned about their most frequent, second most frequent, and third most frequent simultaneous combinations of substances they use. This included requests for details about the specific substances they combine, the frequency of use, the context in which they use these substances (such as with whom and where) and their underlying motives for consumption. In the next section of the survey, participants responded to enquiries concerning any current or past concerns related to their drug use. Following this, they shared their personal encounters with support and counselling services and their perceptions regarding their effectiveness. Finally, sociodemographic information, such as age, sex,

place of residence, school or work situation, and housing situation, was collected. Lastly, participants were invited to leave their contact information if they wished to participate in the focus group. The items of the survey are presented in table 1.

The online survey was programmed on LimeSurvey.

Focus group discussions

The focus groups followed a semi-structured interview guide [90]. The research team developed the questionnaires following the research questions and preliminary answers in the survey in several iterative steps. To ensure that the terms and the "language" fit the target population, research assistants (students) also checked it.

The primary guiding questions revolved around participants' initial experiences with combining substances during one session (e.g. one night/afternoon) (first-time simultaneous polysubstance use) and their current experiences (most frequent simultaneous polysubstance use). Specifically, enquiries focused on usage patterns (which substances are combined), the context of use, the role of peers, harm-reduction strategies, negative experiences and sources of information. Furthermore, participants were asked about their access to information (e.g. regarding harm reduction and where they obtain it or search for it) and their experiences with and suggestions for improvement of support and counselling services.

To avoid any possible linkage to the survey dataset, participants were not asked in detail about sociodemographic characteristics during the focus group discussion.

Recruitment

Survey

The recruitment campaign involved the distribution of flyers (in three national languages) among several project partners (local and national stakeholders from addiction and substance use settings). Furthermore, individuals who received flyers were encouraged to share and distribute them within their networks. Media advertisements were leveraged to enhance the study's visibility. Additionally, the internet and social media played a pivotal role in recruitment, on platforms such as Reddit, Discord, Instagram, Facebook, WhatsApp and other specialised platforms related to the study's topic. However, given that it is almost impossible to place advertisements for an addiction-related research study on an online search engine in Switzerland [91], the ad for the study was placed by the research assistants in forums and groups on their own or via colleagues from the harm-reduction community. The survey was available between November 2021 and March 2023.

Focus group discussion

Survey participants had the opportunity to provide their email address or a mobile telephone number such that the research team could contact them for further information or invite them for an interview. Those who did were invited via e-mail and SMS to participate in an FGD. To increase the response rate, prospects were also informed that they would be renumerated CHF 50 (approximately USD 50) for participating in the FGD. Of 29 individuals who provided contact information, 13 gave their consent to participate in one of two online FGD meetings. For reasons of confidentiality, contact details of participants were stored separately from the survey data such that it is impossible to link the survey answers to a specific FGD participant.

Table 1:
Survey items.

N	Question	Answer type	Scaling
1.	Have you ever consumed two or more substances simultaneously** on the same evening/day?	sc	n
2.	What substances (including alcohol and medications) do you most frequently* mix on an evening/day?	mc	n
3.	How often have you consumed this mixture in the LAST 6 MONTHS?	sc	r
4.	With WHOM do you usually consume this mixture?	mc	n
5.	WHERE does this mixture consumption usually take place?	mc	n
6.	I consume these substances together because…	mc	n
7.	Where do you typically get the medications from?	mc	n
8.	How often in the last 6 months have you consumed other substances in addition to alcohol at the same time?	mc	r
9.	How often do you use the following risk-/harm-reduction strategies**?	mc	r
10.	Has your substance use ever caused you concern (currently or in the past)?	sc	n
11.	Why have you been worried, or are you currently worried? And which substance(s) are you concerned about?	oe	s
12.	Have you ever received support or counselling** for your substance use?	mc	n
13.	What type of professional or organisation supported you**?	oe	s
14.	Was the professional support you received helpful?	mc	n
15.	What was the reason that the support you received was not helpful? What could have been improved?	oe	s
16.	What do you think? How should support services be designed so that young people with simultaneous polysubstance use also use them?	oe	s
17.	The following sociodemographic questions are not listed here …	dif	dif

dif: different; i: interval-scaled; mc: multiple choice; n: nominal-scaled; ni: numeric input; oe: open-end; r: rank-scaled; s: string; sc: single choice.

Some questions were only activated depending on previous answers.

* Questions 2–7 were repeated for the second most frequent and third most frequent consumption.

** Additional explanation was provided within the questionnaire.

Procedure

Survey

All data of the online survey was obtained anonymously. The survey software collected (by the setting) raw data without recording any personal participant information like IP address, software system or region. After landing on the survey page, prospects were informed about the content (as written above). They had to sign the informed consent electronically (opt-in) to proceed to the questions. If participation was refused or the prospects did not meet the eligibility criteria (age, simultaneous polysubstance use, etc.), they were forwarded to a page informing them that they were not eligible for the study. Prospects who met all the criteria were taken to the survey. It was possible to stop (or drop) the survey at any moment. Questionnaire completion took up to 20 minutes.

Focus group discussions

Individuals who chose to participate were initially requested to give their consent through an online platform (including confirmation of voluntary participation, verification of the age range of 14 to 20, prior experience with simultaneous polysubstance use and respect for the anonymity of other FGD participants). Once they provided their written consent, participants were given a link to join the online focus group.

The Head of the Zurich Centre for the Prevention of Substance Abuse (Zürcher Fachstelle zur Prävention des Suchtmittelmissbrauchs [ZFPS]) moderated both focus groups.

The moderator welcomed the focus group participants, expressed gratitude for their participation, and informed them about the CHF 50 compensation. He provided a brief overview of the topic, emphasising the option to decline to answer questions and to leave the video conference at any time. Participants were also informed that they could keep the video turned off during the call. Before proceeding to the central part of the meeting, the most important emergency numbers and contacts, along with relevant counselling and information services, were displayed on the screen.

A brief round of introductions and an introduction to the topic of simultaneous polysubstance use served as a starting point for the core part of the interview with its key questions. Towards the end of the video conference, the moderator reiterated the importance of participants' anonymity in the focus group and directed them to the Institute's website for further information about the study.

Data analysis

Quantitative data analysis

Quantitative data from the survey was analysed descriptively using R. Figures and tables were generated with the package ggplot2 and Microsoft Excel.

Qualitative data analysis

All interviews were recorded and transcribed verbatim. The records were deleted after the transcription. Analysis was conducted on the (Swiss)-German transcript. The quotes within the present article are English translations.

In this study, we adopted the applied thematic analysis method in line with the procedures set forth by Guest, MacQueen and Namey [92]. In order to increase clarity and reduce bias, one team member scrutinised the data to discern key themes and reported these insights to the research team. Then the research team formulated a coding framework, weaving them into an elaborate conceptual structure. Following this, a separate research assistant, previously uninvolved with the early stages of analysis, applied these codes to the data using the agreed-upon framework. The team then jointly verified the final coded data, resolving any ambiguities. All coding tasks were facilitated by NVivo 12 software.

Ethics

Ethical approval for the study was obtained from the Faculty of Philosophy at the University of Zurich (ethics committee authorisation number: 21.6.7).

Results

Survey

Sample characteristics

From the initial dataset of 718 people who entered the first page of the survey, 602 were excluded for various reasons resulting in a final sample of 116 people. The reasons for exclusion were varied: did not complete the questionnaire (n = 430); did not confirm the consent form (n = 113); not resident in Switzerland (n = 22); no simultaneous polysubstance use (n = 22); outside age range (n = 13); ticked the fake item related to consumption of an unremarkable substance (n = 2).

Participant demographics

Of the 116 participants considered for the analyses, around 2/3 were male (n = 77 or 68%) and 31 were female (including 4 nonbinary and 4 who provided no answer). Their mean (± standard deviation) age was 18.2 (± 1.4) years. Most participants came from the canton of Zurich (n = 40, 34.5%), followed by Berne (n = 16, 13.8%) and Lucerne (n = 10, 8.6%). Overall, participants represented 18 of the 26 Swiss cantons. However, most were from German-speaking cantons (n = 100, 86.2%). The majority still lived with their family (n = 87, 75%) or shared a flat with a friend (n = 17, 14.7%). The same was true regarding occupational status, where 92 participants were in an educational phase (e.g. mandatory schooling, high school, college, professional job-related education) (79.3%).

Use patterns

As presented in table 2, the data reveals that most respondents used two or three substances simultaneously regardless of the use frequency category (most frequent vs second most frequent vs third most frequent). At the same, the data shows that for the most frequent simultaneous polysubstance use, at least three substances were consumed. Overall, in contrast, using more than four substances concurrently was infrequent.

Within the most frequently reported simultaneous polysubstance use category, alcohol and cannabis were the two substances most commonly mixed together, with a co-use prevalence of 63%. Additionally, 22% of individuals mixed alcohol with substances other than cannabis (e.g. benzodiazepines), while 11% combined cannabis with substances other than alcohol. Only 4% of participants reported using two substances that were neither alcohol nor cannabis, such as MDMA, cocaine, tranquilisers or painkillers. This pattern of co-use was consistent across the second and third most common polysubstance use types, indicating a general tendency for individuals to combine alcohol and cannabis or use them in conjunction with other substances.

Irrespective of the number of substances used together, the analysis revealed that in the most common simultaneous polysubstance use type, the following substances were frequently used: alcohol, cannabis, amphetamines/ speed (stimulants), cocaine, MDMA/ecstasy (a psychoactive drug), sedatives or anti-anxiety drugs (e.g. benzodiazepines), strong painkillers or cough suppressants (e.g. opioids, codeine), antidepressants, stimulants (e.g. attention deficit hyperactivity disorder [ADHD] medications) and synthetic hallucinogens (e.g. synthetic cannabinoids) (n >10). All other substances had use percentages in the lower single-digit range, indicating their relative rarity in this polysubstance use category; other substances listed were as follows: ketamine; dextromethorphan (DXM, a cough suppressant); natural hallucinogens (psilocybin, mescaline); sniffing substances (adhesives, solvents and gases); spice (synthetic cannabinoids); heroin; morphines; opium; GHB/ GBL/ BDO (γ-hydroxybutyric acid/ γ-butyrolactone/ 1,4-butanediol) central nervous system depressants; methamphetamines (stimulants); salvia divinorum (a psychoactive plant); khat (a stimulant plant); methadone (a synthetic opioid); "bath salts" (synthetic cathinones); research chemicals or legal highs (new psychoactive substances); ibogaine (a psychoactive substance); ayahuasca/ DMT (dimethyltryptamine) (psychoactive brews or compounds). Across all simultaneous polysubstance use frequency types, alcohol was the most frequently used substance. Regarding the frequency of use within the three simultaneous polysubstance use types, we observed the following patterns: the most common type was typically used between once a week and once a month, with 14% reporting weekly use, 28% reporting use two to three times a month, and another 14% reporting use once a month. In contrast, the other two common polysubstance use types were reported to be less frequently used. The second most common polysubstance use type had a prevalence of 38% for use two to three times in total, while the third most common polysubstance use type had 27% of individuals reporting use once and another 27% reporting use two to three times in total.

Use setting

The use setting might be mainly distinguished between the context of consumption (with whom?) and location. The answers to the question regarding the use setting are presented in table 3 below.

Use motives

The motives for the simultaneous polysubstance use were very heterogeneous. The reported motives are presented in table 4.

Harm-reduction strategies

Study participants were asked to assess their use of 21 harm-reduction strategies (based on classic recommendations of prevention centres using a 6-point Likert scale ranging from "Almost always" to "Never"). The analysis identified five strategies reported to be used "Almost always" or "Often" by most interviewees (>75%). These strategies were: how to react in an emergency (If I'm not sure it's an emergency, I dial 144 to be on the safe side), trusted peer (engaging with a trustworthy individual who can provide support and guidance during substance use), informed (staying knowledgeable about the substances being used, their effects and safe dosages), emergency awareness (being aware of emergency procedures and signs of overdose or adverse reactions), water (staying hydrated to prevent dehydration and overheating, especially when using substances that may impair the body's natural hydration cues). On the contrary, most participants (>75%) re-

Table 2:
Number of substances used simultaneously. Tobacco / nicotine not included.

Substance sum	First simultaneous polysubstance use	Second simultaneous polysubstance use	Third simultaneous polysubstance use
	n = 116	**n = 109**	**n = 95**
2	54 (46.6%)	66 (60.6%)	68 (71.6%)
3	32 (27.6%)	30 (27.5%)	20 (21.2%)
4	15 (12.9%)	8 (7.3%)	7 (7.4%)
≥5	15 (12.9%)	5 (4.6%)	0

Table 3:
Simultaneous polysubstance use, including first, second and third most frequent use, by context and location. Multiple choices were possible.

Context	% (n/N [1])	Location	% (n/N [1])
With friends	90.2%	Private/public gatherings (concerts, etc.)	65.9%
Solitary consumption	22.0%	At friends' home	50.9%
With other users/partners	15.0%	Public places	40.2%
		Own home	38.4%
		Educational institutions	2.7%
		Hotel rooms / Airbnb	1.2%

ported that they never or almost never check the substances they use (I have the substances tested before use [drug checking]). The answers regarding other harm-reduction strategies were strongly heterogeneous without specific patterns.

Concerns associated with simultaneous polysubstance use

Approximately half of interviewees (58.6%) reported concerns about their simultaneous polysubstance use (current or past). These concerns were heterogeneous (e.g. anxiety, panic, depression, sleep problems, psychosis, cardiovascular problems, fainting, vomiting, loss of control, loss of interest, loss of motivation, loss of performance, tolerance development, withdrawal symptoms, overdose and death). At the same time, one concern – addiction (being addicted or almost addicted) – was mentioned comparatively frequently (32.8%).

Support and counselling services

More than half of the participants, 59.5%, indicated that they had actively sought support or counselling for issues related to substance use. Among those who sought assistance, the majority, 71%, identified their friends as the primary source of support or counselling. Furthermore, 32% of participants sought support from their family members, while 37.7% sought professional support or counselling.

The professional support predominantly consisted of addiction counselling or outpatient therapy, typically provided by psychologists or psychiatrists. The use of inpatient therapy was reported very seldom.

When assessing the perceived effectiveness of professional help, 58.7% of participants rated it as partially helpful, suggesting a moderate degree of effectiveness. In contrast, 11% of participants deemed professional support not helpful, implying a lack of perceived benefit from these interventions.

Focus group discussion

Sample

Depending on their availabilities, 13 prospects were allocated to two online FGDs conducted in the first half of 2022 with three 3-month intervals (4 vs 9). However, one person in the first FGD did not show up, resulting in a final sample of 12 participants in two FGDs (n = 3 and n = 9). Each FGD lasted approximately 90 minutes.

Use patterns

The majority of participants talked about the combination of alcohol and cannabis or hashish (mostly first-time simultaneous polysubstance use as well). MDMA with alcohol was mentioned frequently by interviewees as well as one of the "starter" polydrug combinations. Other combinations (not only related to the first-time of the interviewees but of the polydrug consumers in general) were described rarely (e.g. benzodiazepines, LSD, codeine and unspecific [unknown] drugs); however, some statements were related to medical drugs without specification. Overall, the pattern of a combination of "a substance" with alcohol was reported throughout all interviews as part of the first simultaneous polysubstance use. Examining the current (most frequent) simultaneous polysubstance use, MDMA surpasses alcohol as the most frequent substance. Cocaine and "weed" was the third most mentioned substance. Other substances such as amphetamines, benzodiazepines and nitrous oxide (laughing gas) were mentioned as well, but rarely.

Use settings

The majority of interviewees reported using it on "raves", at parties or in clubs, as the following quote highlights: *"[...] And for MDMA also quite similar. Pre-drink, afterward to the club, then take a pill or crystal"* (FG1; IP3). If not in the setting mentioned above, participants described the polysubstance use practice at home or outside as *"[...]*

Table 4:
Motive for substance use. Multiple choices were possible. First, second and third simultaneous polysubstance use (SPSU) refer to frequency category.

Mentioned motives	Proportion mean (%) based on first SPSU, second SPSU, third SPSU		Motives mentioned at least for one frequency category (n)	
	Reinforcement			
	Positive	Negative	Positive	Negative
It's fun	66.1%		87%	
It feels good	58.1%		83%	
Parties get better because of it	36.4%		51%	
Effects of the substances are enhanced	33.0%		47%	
Substances fit into the environment/ plans	30.8%		45%	
Substances are readily available	26.0%		37%	
Desire to experience with friends	25.3%		33%	
Helps to be more relaxed/less shy		24.2%		40%
Aids in staying awake longer	22.8%		27%	
Helps to deal with stress		19.0%		28%
Seems to be common	15.8%		27%	
Helps sleep better/relax		15.6%		19%
Combines substances due to side effects*	11.0%		21%	
Other motives (each <5%)	<5%		n/a	

n/a: not applicable.

* Most frequently related to the item "I need to consume less of each substance to achieve the same effect".

Rarely at parties, but at home with friends or roaming around outside" (FG1; IP3). When outside use was reported, MDMA was usually part of the use: *"[...] I had MDMA [...] mostly outside [...]"* (FG1; IP1) or *"Then we go outside talk and walk around on MDMA and then smoke another joint"* (FG1; IP2). However, regarding the question with whom they practice simultaneous polysubstance use, parity was observed between alone and with friends, as presented in the previous and the following quote:

"So, with me, it's always about the same circle, especially at the beginning of the evening. But over the evening, you might also meet other colleagues or acquaintances at a party or something or people you know from school. But it's mainly in the close group of friends, and there are also girls there. With us, it's divided up a bit like that. Mainly the girlfriends of the best colleagues, but also other girls." (FG1; IP3)

Use motives

Asked about the motives, many participants stated that they use substances to regulate the effects of other substances. However, they distinguished between the enhancement of the effect and the reduction or avoidance of undesired (side) effects:

"With nitrous oxide in general, you get tunnel vision like that. And the acoustics echo a bit. You get a kind of euphoria in your stomach, which is quite intensified by the MDMA. MDMA intensifies the laughing gas [nitrous oxide] a lot [...]" (FG1; IP1) or

"[...] And the effect is much stronger if you still take weed" (FG1; IP2) or

"so, benzos alone, when you take it, it's more like subconsciously you don't even feel it, you just get calmer, you can go down. But when you take benzos, that is the consciousness that you don't know much the next morning. And the alcohol makes that you are a little bit more there and you have more energy, but still like a drunk kind of but more special. With the weed, it's more the opposite, that you get a little bit limp. Still there but rather have no energy. The next morning, I no longer knew much, like a film tear" (FG1; IP3).

Other substances – such as amphetamines and cocaine – were used to stay awake longer or to feel energised when tired. Finally, reasons such as *"it must simply flash,"* or *"it is simply a good feeling,"* or to come down from a "bad trip" were expressed as well, though only a few times.

Harm-reduction strategies

Regarding the knowledge and information-seeking strategies, participants reported using the information they found online. A wide range of information sources and platforms were mentioned: saferparty.ch (*"they have an online page and Instagram page and they always post tests from all over Switzerland and if you find the same pill, then you can interpret that it is the same pill that you have"* [FG1; IP3]), know-drugs.ch (*"there I also look which combinations are maybe not so clever"* [FG1; IP1]), Google (*"[...] when I google, I usually get, I don't know exactly what it's called, but then I usually get an excerpt of a website directly and I have the impression that it's trustworthy. The first thing that is displayed"* [FG1; IP3]), YouTube (*"an italic>open mind is one, for example, and the other one, I'm not sure anymore, is called Rauschkunde or something. An open mind is definitely good. Then there's especially for psychedelics psych substance, that's an American Youtuber and the Quentin experiment, that's a Canadian, but he's mainly specialized in mushrooms"* [FG1; IP1]), Reddit (*"Then I was on Reddit a lot. And Reddit has many forums, there I had entered the new drug then and looked what other people have experienced and have tips"* [FG2; IP7]), darkscout ("*there, all write their trip experiences purely"* [FG2; IP8]), SuchtSchweiz ("*For each drug you can find facts and figures, that's pretty good."* [FG2; IP8]), Instagram ("*the sites Drugfactory and Saferparty, where I get information and I came across you through that. I have already filled out 4–5 times such surveys*" [FG2; IP8]) and Eve&Rave (*"[...] They make good stuff, too. For coke, there were rolls of cloth that you could roll. There is also such a website"* [FG2; ID8]). In addition to gathering information online, many participants also exchanged experiences with peers: *"The one college has stories from the parents or stories from the environment, where you just already know a little bit what is what and then you inform yourself a little bit more about it"* (FG2; IP5).

Concerning the harm-reduction strategies, two out of three participants have reported already testing their substances: *"So mostly with a lab thing like that. Then we know how much is in it. You get an exact report"* (FG1; IP2) and *"I get it from a colleague who also sells this. And I know where he goes to test it and I also went to test it myself when I got it from him. And it was always tip-top"* (FG1; IP1). The reasons not to test substances were mostly connected to the testing possibility: *"The problem is mostly that where I could go test, that is only every two weeks. So it happens that I miss it a bit, and then it's too late, and I have no possibility to test"* (FG1; IP3). In the case of prescribed drugs, particular attention was paid to the packaging of the substances, as this example showed: *"Well, with benzos, I mainly look to see that it's either in a blister, so... I think it's called a blister, isn't it? So, these pharmaceutical packages. Or that it is in a plastic box and that it is not just packed in a bag and sold like that, but that I am sure that it is really from some pharmaceutical industry"* (FG1; IP3).

Additionally, most interviewees reported using a trip sitter or having someone at home, for example: *"So with us, it's also the case that two to three don't take anything. We usually have a trip sitter who only drinks alcohol or doesn't take the harder stuff. So, someone who is still a bit clear if something goes wrong. "* (FG1; IP2). Furthermore, several respondents described making notes – *"on the cell phone"* or *"on the hand"* – about the substance and quantities consumed.

Concerns associated with substance use

Concerns about substance use were reported just a few times, and when they were, it was by denying perceiving it as a problem or making a negative association towards this behaviour, as an example illustrates: *"I would say because I don't really see a problem in my consumer behaviour, or at least not a big problem, because I'm not really in an addiction"* (IP2; IP5). When concerns were raised, it always was related to hearing something from other users:

"But for example, about the use of benzos and alcohol, I have already heard very, very many bad things about that, also in advance, that you should not really do that, that it can also be fatal. But also, in my environment, it [the consumption] happened quite often, and I never heard anything really bad. But sometimes it scares you a little bit because it changes the image that it's actually not that bad, and subconsciously I have a lot of respect for it because I don't really know what could happen". (FG1; ID3)

All in all, however, the participants consider their own polydrug use patterns to be relatively harmless.

Support and counselling services

The majority of participants were not in favour of the counselling and support services and reported rather negative experiences and a need for improvement, as the following quote shows:

"Well, I don't know, I thought they were kind of not responsive to me... well, I don't know, they're just not psychiatrists, you know? They told you so impersonally how bad smoking pot is, which is actually what you hear from your parents, you know?" (FG2; IP9).

The criticism was often related to the lack of personal commitment – *"Yes, it's also extremely difficult because they do it every day with different people and they can't make it extremely personal at all"* (FG2; IP9) – or not to be informative enough: *"It's as if you were going to school or something and they wanted to teach you something that you already know in a way"* (FG2; IP8). All these aspects are complained about not only in relation to interviews with professionals but also online tools.

In line with the comments mentioned above, limiting the prejudice and stigmatisation – *"without being labelled"* (IP2; IP7) – was mentioned by several participants as a key wish or suggestion for improvement of counselling services. Interviewees described it as follows:

"Always keep the finger instead of an open hand . That is also a problem. Why go there if you're just going to get a moral lecture? No one likes a moral lecture and certainly not in a situation like this" (FG2; IP1) or

"More the understanding that there really is a disease that people, a few people, can't control" (FG2; IP7) or

"It must not be so strict. It needs to be more collegial" (FG2; IP8).

Some participants believe that consumers or professionals with personal experience (peers) would make such offers more useful. However, they are aware of the difficulty of implementing this.

Discussion

This study aimed to comprehensively investigate the patterns and characteristics of simultaneous polysubstance use among Swiss adolescents aged 14 to 20, a population that has received limited research attention. Except for several other investigations – mostly only quantitative surveys – this is one of the first studies in this area [79–81]. Besides some limitations and slightly different settings in other studies, a mixed-methods approach combining quantitative survey data with qualitative focus group discussions was applied to gain first, profound insights into the phenomenon of simultaneous polysubstance use among Swiss adolescents. This integrated approach allowed for a more nuanced understanding, surpassing the limitations often associated with solely quantitative or qualitative investigations. From this point of view, the present study fills a critical gap in the current understanding of simultaneous polysubstance use among Swiss adolescents.

The quantitative phase of our study provided valuable answers about the demographic and usage patterns of the surveyed adolescents engaged in simultaneous polysubstance use. The sample was predominantly male, with an average age of 18.2 years, and represented various cantons across Switzerland, with a notable concentration in German-speaking regions. Most participants lived with their families or shared a flat with friends and were in education. Even the outcome that most participants came from German-speaking regions might be explained by the fact that the majority of the Swiss population speaks German as their first language and that the research team is also based in German-speaking regions. This result regarding the living situation was not a surprise either, given the age of the participants and the duration of education in Switzerland (only around 10% of young people under the age of 20% live outside of their parental families in Switzerland). However, the sex disparity allows the first tentative question of whether adolescents involved in simultaneous polysubstance use are statistically more frequently males. Another possible interpretation of the sociodemographic data might be that there is no typical simultaneous polysubstance consumer, and even more, these consumers seem to be an "invisible" group given their intact embedding in the family and educational structure. That might make it even more challenging to identify and address them through tailored prevention measures.

The survey data revealed that most respondents reported combining two or three substances concurrently, with combinations involving more than four substances relatively rare. Alcohol and cannabis emerged as the most commonly mixed substances, followed by combinations of alcohol with substances other than cannabis. This pattern of co-use was consistent across different use types. Moreover, these findings match other field results [34, 36–39, 58, 65–68, 93–95]. The frequency of simultaneous polysubstance uses varied, with the most common type being using between once a week and once a month. The less frequent users consumed only occasionally. This finding suggests a presumption that simultaneous polysubstance users are not necessarily sensation seekers (as discussed in other publications [79]) and are curious to try new combinations but choose their products based on precise expectations of the intended effects. Furthermore, the frequency of simultaneous polysubstance use combined with the sociodemographic specifics mentioned above, as well as the result that participants practice polysubstance use almost everywhere, supports the assumption of an "invisible" group, as hypothesised above. Unfortunately, the lack of comparable results from other studies makes it challenging to provide a valid comparison to other findings. Therefore, this outcome may be interpreted only from an exploratory point of view.

At the same time, additional worrying patterns might be identified from the results. On the one hand, even though

the majority reported simultaneous consumption rather than "for fun", a considerable group of participants, up to one quarter, talked about maladaptive coping strategies and negative reinforcement for the consumption. This result raises the question about self-medication and the risk of increasing addiction-related behaviour. The problem of self-medication through substance consumption leading to addiction by common mental health disorders is well-known [96, 97]. Additionally, the fact that every third interviewee already reported addiction-related concerns hardens the severity of the issue that needs to be strongly addressed in the prevention and interventional work regarding simultaneous polysubstance use in adolescents. On the other hand, even though the participants reported using at least a couple of harm-reduction strategies while using the substances, they almost never checked it before (drug check). That might not be a big deal in the case of alcohol and medical drugs from legal manufacturers, but it might have an enormous risk for health and life in the case of the simultaneous use of legally produced drugs with unknown content. Another dangerous pattern was the fact that every second participant seemed to use at least three substances concurrently. Considering the previous outcome regarding the lack of drug checks, it multiplies the risks for hazardous results on the health or even the life of the simultaneous polysubstance users.

The qualitative phase of the study, conducted through focus group discussions, provided more profound insights into the motives, settings, harm-reduction strategies, concerns and experiences with support services among the adolescents engaged in simultaneous polysubstance use. Participants often cited motives such as seeking positive experiences, enhancing the effects of substances and adapting to social environments. However, compared to the survey, they didn't mention any aspects of negative reinforcement. This aspect is interesting and questionable at the same time: was it, in fact, only consumers "for fun" and in this case, why were the individuals practicing simultaneous polysubstance use as self-medication reluctant to participate in focus group discussions, or was no one prepared to talk about the maladaptive strategies in front of other interviewees? Regardless of the exact answer, this aspect raises justified questions about self-stigmatisation regarding the reasons for simultaneous polysubstance use among adolescents. Furthermore, the role of peers was prominent, with many participants emphasising the importance of social settings, such as parties, clubs and gatherings. The qualitative results on these issues were mainly comparable to the quantitative results mentioned.

Regarding the answers to the harm-reduction strategies, the answers were strikingly inconsistent. Even though participants reported in unison about several frequently used harm-reduction strategies, most of the strategies seem still to be used only sporadically, and a significant number of consumers might be unprepared for the risk of simultaneous polysubstance use due to limited knowledge and low retrievability of these strategies resulting in potential harm outcomes for health in an acute situation.

Interestingly, concerns related to simultaneous polysubstance use were infrequently reported among participants. Even when concerns were mentioned, they were often downplayed, and participants generally considered their own use patterns relatively harmless. It somehow corresponds to the fact that no aspects of negative reinforcement are mentioned. This contrasts with the existing literature, which often highlights the risks and negative consequences associated with polysubstance use [98, 99]. It was also striking that high-risk consumption patterns were reported despite the harm-reduction strategies mentioned. However, the risk perception of these patterns appeared to be greatly underestimated by some of the respondents. For example, MDMA doses were reported that exceeded the maximum dose recommended by harm-reduction experts by more than three times. Another problem is the fact that the information often appears to come from influencers on social platforms such as YouTube. Some of the content they provide is highly problematic from a prevention and harm-reduction perspective. This clearly shows that it would be necessary to better educate young consumers about the risks and adequate risk-reduction strategies.

Another notable finding was the participants' negative perceptions of support and counselling services. They described these services as unresponsive, impersonal and lacking in informativeness. Participants often felt stigmatised and being moralised to during interactions with professionals. They expressed a desire for more empathetic, non-judgemental and personalised approaches to addressing their substance use concerns.

Limitations

This study provides valuable insights into the patterns, motives and experiences of Swiss adolescents engaging in simultaneous polysubstance use. However, several limitations should be considered when interpreting the results.

First, the sample size for the survey and the focus group discussions was relatively small and may not represent all Swiss adolescents engaged in simultaneous polysubstance use. It is essential to highlight that individuals willing to participate in research – especially those in focus group discussions – may differ from those who did not, potentially introducing selection bias. Here, it needs to be mentioned that even though it was not accessed in detail, it was obvious (based on answers) that some participants of the second focus group discussion were "heavy users". At the same time, it merits being brought up once more: the focus of the study was on the adolescents already involved in simultaneous polysubstance use, so from this point of view, it does not allow any conclusions to be drawn regarding the entire population of adolescents in Switzerland.

Second, the survey sample was recruited through various methods, including online platforms and social media. This approach may have disproportionately reached individuals who are more active online or more open about their substance use, leading to a non-random and non-representative sample even related to the maximum variation sampling strategy.

Third, data collected in this study relied heavily on self-reporting, which may be subject to recall bias, social desirability bias and underreporting of sensitive information. At the same time, participants may have been hesitant to disclose specific details about their substance use practices or experiences. However, the anonymity of the survey mitigates this consideration. Alongside the fact that the inter-

views were unable to provide anonymity in the same way as the survey, it might explain why participants were rather reluctant to speak about the negative aspects of the simultaneous polysubstance use compared to the results from the survey.

Fourth, most study participants were German speakers, and the study may not fully capture the experiences and motivations of adolescents from language and cultural minorities in Switzerland. The lack of diversity in the sample may limit the generalisability of the findings even for the target population.

Fifth, the present study employed a cross-sectional design, which provides a snapshot of substance use behaviours and experiences at a single point in time. Longitudinal studies would be necessary to understand how these behaviours evolve and assess (possible) causalities.

Sixth, the study did not collect clinical data on participants' physical and mental health status, which could provide important context for understanding the consequences of simultaneous polysubstance use. Without such data, it is challenging to draw definitive conclusions about the health implications of polysubstance use in this population.

Seventh, participants who reported seeking support or counselling services may have had different experiences and motivations for doing so than those who did not seek help. This potential response bias could impact the findings related to the effectiveness and use of support services.

Finally, the study did not extensively explore unique factors that may contribute to polysubstance use among adolescents, such as peer pressure, developmental factors or the role of family dynamics. A more comprehensive understanding of these factors could inform prevention and intervention efforts.

Implications and future directions

The findings of this study have several implications for both research and practice. First, our study contributes to the understanding of simultaneous polysubstance use among Swiss adolescents, shedding light on the complex interplay of motives, settings and harm-reduction strategies in this population. These insights can inform the development of targeted prevention and intervention programmes and should be used for future research.

On the one hand, public health stakeholders should be aware of the specifics of the simultaneous polysubstance users and not ignore the issue due to the "invisibility" of this target group. On the other hand, cost-effective actions with a high level of public attention, such as a "drug take-back programme" or "medication disposal programme" (whereby people take expired or unused medicines to a pharmacy or a designated location to prevent misuse or abuse), should also be considered. Such programmes provide a safe, convenient and responsible means of disposing of prescription drugs while also educating the general public about the potential for abuse of medications. They might be an essential tool in addressing the simultaneous polysubstance use in adolescents, given the fact that a significant part of the users misuse substances received with a prescription (for themselves, family members or friends). Another intervention might be the implementation of controlled medication dispensing by parents (or even general practitioners) as a standard procedure.

The partly negative experiences reported regarding support and counselling services suggest a need for improvements in the delivery of such services. Professionals should strive for greater empathy, personalisation and sensitivity to the unique needs of adolescents engaged in simultaneous polysubstance use. Additionally, efforts to reduce stigma and moralising attitudes are crucial for making these services more accessible and acceptable to this population. Future research on this issue should delve deeper into understanding the effectiveness of existing counselling services from the perspective of adolescents engaged in simultaneous polysubstance use. This includes assessing the impact of service delivery methods, content of counselling sessions and the overall quality of therapeutic relationships.

Given that alcohol seems to play a key role in adolescent simultaneous polysubstance use, targeted prevention measures are crucial. Strict enforcement of the legal drinking age and tighter controls on alcohol sales and advertising can reduce access and appeal. Educating parents and communities on the risks of adolescent alcohol use in combination with other substances is essential as well. An additional step might be the introduction of warning labels on alcohol bottles about the lethal dangers of simultaneous polysubstance use, similar to those for pregnancy and drinking, which can raise awareness and deter dangerous behaviour. Also, this measure would address not only adolescents but all alcohol consumers, as polysubstance use can affect individuals beyond just the youth.

Furthermore, future research in this area could explore the long-term consequences of simultaneous polysubstance use among Swiss adolescents and the effectiveness of interventions tailored to their specific needs. Additionally, investigating the feasibility of peer-led support initiatives may be worthwhile, as some participants expressed a preference for peer-based assistance. In combination with the research, new targeted intervention and prevention strategies are essential to address the needs and challenges of adolescents with simultaneous polysubstance use effectively. Given the diverse use patterns and motives, designing strategies tailored specifically to this target group requires a nuanced approach. A one-size-fits-all approach would not accommodate the diversity of simultaneous polysubstance use. Targeted prevention should focus on those who already exhibit problematic polysubstance use and those at risk. Identifying risk factors and early warning signs can help in offering support to adolescents before their consumption worsens. Interventions must be low-intentional and easily accessible to reach adolescents. This may involve offering services in places adolescents frequent: adolescent centres, online platforms and parties. Reducing bureaucratic barriers and stigma is also crucial. Peer support can be an effective strategy to reach adolescents engaged in simultaneous polysubstance use. Other adolescents who have had similar experiences can serve as credible messengers and act as conveyors of information and support. Interventions should aim to reduce consumption and strengthen protective factors such as social support, mental health and life skills. These factors can help reduce the risk of problematic simultaneous polysubstance use. Since adolescents from different social milieus – espe-

cially in Switzerland, where almost one in two people has a migrant background – may have different experiences and perspectives, targeted strategies should be sensitive to dimensions of diversity and equity. This may involve considering social norms, values, practices and experiences of discrimination.

Data sharing

The datasets and the original questions in German, French and Italian are available upon reasonable request from the corresponding author.

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