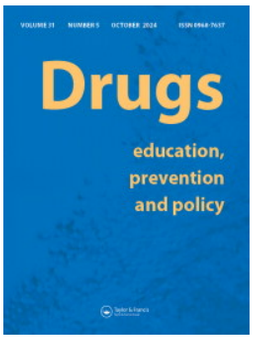

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'I will not use it because the results are bad' – understanding the influence of the drug checking service on changing consumption behavior

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ABSTRACT

Background: Based on the theories of reasoned action and planned behavior, this study aimed to investigate the impact of drug checking services (DCS) on clients' consumption behavior and to assess the intention to use drugs based on DC results, underlying motives and the consistency between intention and actual behavior.

Methods: Two anonymous questionnaires were sent to the clients of a Slovenian integrated DCS (No = 364), the first when the DC results were returned by e-mail – including closed and open questions – and the second after 10–14 days to check whether the first intention was maintained.

Results: The results show that the information provided by the DCS fosters the intention to avoid the use when the substance tested is not the one expected (65.5% of cases), with a strong correlation between the level of health risk of the sample (adulterations, substance other than the one purchased) and attitudes towards drug use.

Conclusion: Although the results should be strengthened by including larger samples, the study has demonstrated the potential of DCS to reduce health risks, particularly among PWUD and provides an example of how the impact of DCS on behavioral choices can be investigated.

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Drug checking; drug consumption behaviour; harm reduction; behaviour change

Introduction

Among the various harm reduction strategies that respond to the risks associated with the use of illicit substances, drug checking services[1] (DCS) have been introduced in several European countries, including Slovenia (Brunt, 2017; Sande & Šabić, 2018) as well as in North, South and Central America and Australia (Betzler et al., 2021; Harm Reduction International, 2022; Karamouzian et al., 2018). DCS consists of analyzing drugs to identify their ingredients and returning the results to service users with the intention of helping people who use drugs (PWUD) to reduce risk without judging their decision. As a public health focused service, the drug checking service uses the results of the analysis to engage the client in a conversation aimed at contextualizing the risks to which s/he is exposed, including discussing interactions between the substances detected and explaining any quantitative results. The DCS should enable an exchange of information between the service user and the service in order to customize the advice given to the PWUD as part of the harm reduction measure (TEDI, 2022).

In Slovenia, anonymous sample collection[2] at the two NGOs (DrogArt and Stigma) has been possible since 2006 as part of the Early Warning System on new psychoactive substances, and the system was expanded in 2016 to include seven new sample collection points at six other NGOs. The evaluation of the sample collection at the time (Sande & Šabić, 2018) has highlighted the weaknesses and the opportunities for the future introduction of an integrated DCS with the involvement of professionals providing additional explanations on the risks of the tested substances and counselling, as well as the monitoring of trends in the drug market. The results show that the main barriers to the use of DCS in Slovenia are the long waiting time for results, the fear of losing anonymity and the fear of legal problems. Service clients from two samples, party goers and high-risk PWUD from harm reduction programmes, indicated that they would not object to a brief consultation during sample collection. The results formed the basis for an improved DCS in Slovenia, with shorter time to obtain results, better accessibility and sample collection points that are also available for PWUD outside the nightlife (ibid.).

With the support and funding of the Ministry of Health and European Social Fund, a new DCS with a faster response time and integrated counselling service was introduced in 2018 at DrogArt and existing sample collection points. The analyses were carried out by the project partner organization National Laboratory for Health, Environment and Food using the most accurate methods (e.g. HPLC-DAD, GC-MS, LC-MS,

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FTIR-ATR) for drug checking, which provide very reliable results. After the end of the project in 2023, the DCS was funded by the Ministry of Health of the Republic of Slovenia.

Like many other harm reduction measures, drug checking aims to influence people's behavior by providing them with accurate information about the potential risks of their drug use and specific strategies to minimize the risks associated with drug use. Some authors assume that lower-risk substance use appears to be related to self-control and self-regulation of people who use drugs (PWUD) (Cruz, 2015; Fishbein & Ajzen, 2010). These positions assume that people are rational in their decision and use the information available to them. Two cognitive theories provide a dominant theoretical framework for understanding how people behave in certain contexts (LaCaille, 2013) and to investigate health related behavior (Cutrín et al., 2020). The theory of reasoned action (TRA) (Ajzen & Fishbein, 1980) and the theory of planned behavior (TPB) (Ajzen, 1991) assume that the intention to engage in a certain behavior is the best predictor of whether a person will actually engage in that behavior. TRA has been used to support the prediction of certain health behaviors (LaCaille, 2013) such as alcohol (Cutrín et al., 2020) and drug use (Cruz, 2015). Both theories have been extensively validated empirically, supporting their usefulness in explaining a range of behaviors, including drug use (Armitage & Conner, 2001), and they serve as an important theoretical foundation for several DCS. Recent studies (Valente et al., 2024) support the hypothesis that DCS encourage the adoption of safer drug use practices, as most PWUD using DCS at festivals reported not using a substance when the results were unexpected.

In the TRA, Fishbein and Ajzen argue that actual behavior (e.g. drug use) is based on behavioral intentions. These intentions are a function of salient information about the likelihood that a particular behavior will lead to a particular outcome (e.g. risk or harm) (Madden et al., 1992).

The theory of planned behavior (Ajzen, 1985) extends the boundary condition of pure volitional control established in the theory of reasoned action to increase the accuracy of behavioral predictions. This is achieved by incorporating beliefs regarding the possession of resources and opportunities to perform a particular behavior. The more resources and opportunities individuals believe they possess, the greater their perceived behavioral control over the behavior should be. However, the TRA and TPB have also been criticized because they are not falsifiable (Trafimow, 2009) or because they focus exclusively on rational thinking, which excludes unconscious influences and the role of emotions on behavior (Sniehotta et al., 2014). Thus, the influence of rational reasoning may apply well to some of the PWUD, but other and more marginalized individuals may be subject to unconscious influences and emotions that can lead to riskier outcomes of drug use. Apart from this, more complex social and structural factors may also have an influence on drug use and decision-making, particularly for marginalized individuals.

A recent study (Betzler et al., 2021) investigating the potential impact of drug checking conducted with online questionnaires not linked to a real-life service showed that two-thirds of respondents would discard the sample if it contained an unexpected/undesirable substance in addition to the intended substance. If the sample contained only unexpected/undesirable substances and not the intended substance, 93% stated that they would discard the sample. Similar results have been shown in other cross-sectional studies without DCS provision to respondents (Day et al., 2018; Johnston et al., 2006).

Several studies (Measham, 2019; Martins et al., 2017; Michelow & Sage, 2017; Michelow & Dowden. 2015; Saleemi et al., 2017; Valente et al., 2019) examining behavior change – e.g. disposal of unwanted substances – were conducted at various festivals in Europe and the United States where DCS was available in some form. The results show that participants whose substances were not the expected ones were significantly less likely to express an intention to use the substance than PWUD whose substance outcomes were expected. There was also a statistically significant relationship between PWUD behavioral intentions and drug-checking outcome. Only two studies (Measham, 2002; Valente et al. 2022) have investigated actual behavioral change in PWUD by performing a follow up. Valente and colleagues (2022) tested the validity of behavioral intention measures using reports of actual behavior. At third-day follow-up, when results were not as expected, 86% reported that they had not taken the substance, 11% took a smaller dose than originally planned, and only 3% took it as planned. 71% of responses provided at the third day follow-ups, were consistent with the behavioral intentions reported when receiving the drug analysis results. In the second study by Measham (2002), results at follow-up were consistent between actions and intentions in nine of the ten measures, including the fact that more than half of service users disposed of samples identified as different than expected and two out of five reported a lower dose for samples identified as expected.

The results and evaluation of integrated DCS for more marginalized individuals (Karamouzian et al., 2018) in a supervised injection site in Vancouver, Canada, showed that among DCS users whose samples tested positive for fentanyl prior to use, 36% intended to reduce their dose, and that intended dose reduction was significantly associated with a lower likelihood of overdose. As far as we know, this is the only available evaluation study on DCS for people who inject drugs. In addition to the linear and beneficial individual behavioral change of DCS users, we can also observe some other and broader socio-ecological impacts of DCS. Indeed, DCS also contribute to quality control in the unregulated market (Maghsoudi et al., 2021; Wallace et al., 2022), but more in the form of identifying higher-risk supplies and providing information for PWUD than having an impact on the unregulated market. There are also indications that future DCS implementations may lead drug dealers to test their supplies and provide drug content information to their customers (Bardwell et al., 2019), but such an endeavor is not without limitations and risks, as is the case in Slovenia, where we restrict access to the service if the PWUD is clearly using it to test different batches.

From 2018 to 2023, a large-scale evaluation of the above-mentioned integrated DCS in Slovenia took place at the NGO DrogArt. The results showed that the service was used 2,791 times, with 1,336 brief harm reduction interventions on the risks of certain substances and other topics, as well as the distribution of accurate dosing utensils, condoms,

brochures, lubricants, etc., and 398 counselling interventions. Brief harm reduction interventions were offered to all users of the service and counselling interventions to those in greater risk. Brief harm reduction interventions were offered to all users of the service and counselling sessions for those who were at higher risk. After they have been received by the laboratory, the drug checking results are sent to the PWUD by e-mail together with the harm reduction advice. In the period under observation, about 1000 samples per year have been checked, with some fluctuations in the years of the COVID-19 pandemic, and between 11 and 36 alerts per year were sent to the Slovenian Early Warning System (EWS). This article will present and discuss only a small part of this large-scale evaluation, which aimed to understand the impact of the DCS on the actual behavior of service users.

Method

Two different data-sets, collected through different research methods, were used for this study.

The first set was conducted with a mix methods approach, as part of the continuous data collection conducted since the beginning of the updated DCS in Slovenia in 2018 in the DrogArt association[3]. The aim was to measure the intention to use drugs after the results were known and the reasons for the individual decision. When the results were emailed back to PWUD with harm reduction advice, we asked two additional questions. The first was a closed-ended question about the intention to use drugs once the result was known: "Now that you know the result, will you use the substance?", with the answer options "yes", "no" or "I don't know". The second was an open question: "What is the reason for your decision?". The answers to the open question were analyzed and coded. Similar codes were then merged, resulting in different categories for positive and negative intentions regarding drug use.

The second data set is based on a quantitative online follow-up questionnaire, which aimed to investigate actual behavior and determine whether it corresponded to the previously expressed intention. These data collection ran for 6 months between October 2021 and March 2022. The questionnaire was created on Google Forms and this link was sent in the same way as the service user's decision to receive the results – by email or phone. To ensure anonymity, users of the service had to enter the sample's unique code on the form, which established the link between the results of drug checking and the behavioral measure. The form was sent out between 10 and 14 days after receiving the drug checking results to check PWUD behavior after receiving the DC results. The aim was to wait long enough to capture the opportunities for drug use that typically exist for PWUD recreationally on weekends. Waiting too long would further decrease the response rate and could affect the stability of intentions between the time of measurement and the performance of the behavior.

The follow-up questionnaire consisted of two questions designed to explore different possible outcomes of the PWUD behavior. The first question asked PWUD what they had done with the tested substance, with the following possible answers: thrown away, consumed, returned to the dealer, given to another person or nothing. The second question was directed at those who had used the substance and investigated whether or not they had changed their planned behavior by taking a lower or higher dose, based on the DC results. Of the many other possible consumption behaviors, only dose adjustment was selected because it can be directly influenced by the quantitative DC result.

In the follow-up there were responses for 55 samples, from which we were able to gain a general insight into behavior after using the DCS. To compare the change in behavior in relation to the risk of the drug sample, 15 responses that could not be linked to the drug sample were removed because the individual drug sample code was missing or incorrectly entered. Two further responses were removed because they were brought as unknown substances and the risk assessment between purchase and result could not be calculated. 38 responses from 29 participants were analyzed, as more than one sample could be tested.

To see if the action followed the intention, the responses were categorized according to whether they used the substance, disposed of it, returned it to the dealer or gave it to someone else.

To gain better insight into how intentions and behaviors might change depending on the perceived risk from the drug checking analysis results, four categories were created based on health risk of the sample (Table 1).

The basic results of the study were presented using descriptive statistics. To determine the relationship between the health risks and the behavioral intention following the test results and to check whether the behavioral action follows the intention, we used chi-square tests.

We conducted the study in accordance with the Code of Ethics for Researchers at the University of Ljubljana. All respondents were given verbal informed consent to participate in the study, which included basic information about the purpose of the study, participation in the study, anonymity and publication of the records, and risks.

Results

Sample and descriptive statistics

Between March 2018 and February 2022, 499 different samples from 364 visitors to DCS in the study were collected. As it is an anonymous service, the number of visitors rather represents access to the service and not total number of unique users of the service. Out of 499 samples collected, 18 samples did not specify a purchased substance. These were usually found or acquired as gifts and were excluded from the study. The response rate for the first data collection was 18.9%. Of these, 71.8% stated that they intended to use the analyzed substance, 23% stated that they would not use the analyzed substance and 5.2% had not yet decided (n = 481).

The gender of the respondents corresponds to the gender structure of all visitors to DCS: 84 (23%) were female and 280 (77%) male. The average age of the participants was 26 years. The socio-demographic data of the respondents to the follow-up questionnaire are similar: 7 (24%) were female and 22 (76%) were male, with the average age of the participants

Table 1. Risk categories of drug samples.

Category	Consistency of result with purchase	Additional information
1 – no additional risk	The result of the analysis shows that the sample contains the purchased substance without other adulterants.	Adulterants do not include other synthesis products (e.g. iso-LSD in LSD samples), naturally occurring alkaloids (e.g. benzoylecgonine in cocaine samples, noscapine in heroin samples, etc.) and other related substances (e.g. other cannabinoids in cannabis samples, psilocin in mushroom samples, GBL in GHB samples).
2 – low additional risk	The result of the analysis shows that the sample contains the substance purchased, with one or more inactive adulterants or one or more psychoactive adulterants in smaller quantities.	The lower amount of psychoactive adulterants in the sample is determined by the threshold dose of the respective substance (e.g. caffeine in amphetamine samples < 10%) or by the limit of increased risk (e.g. levamisole in cocaine samples < 5%).
3 – high additional risk	The result of the analysis showed that the sample contained a purchased substance with one or more psychoactive adulterants in larger quantities..	The greater amount of psychoactive adulterant in the sample is determined by the threshold dose of each adulterant (e.g. caffeine in amphetamine samples > 10%) or by the increased risk limit (e.g. levamisole in cocaine samples > 5%). All samples for which a quantitative analysis of the detected impurities was not possible were also included in this category.
4 – very high additional risk	The result of the analysis showed that the sample did not contain the purchased substance, but one or more other inactive or psychoactive substances[5].	

being 25 years. Of the 29, 12 were involved in information exchange and counselling and 13 received only information and one only counselling (data missing for the others). The age structure of the participants included in the study is younger compared to that of the entire DCS system in Slovenia, as the DrogArt Association, unlike the other organizations, is primarily aimed at young people. Consequently, the samples collected by DrogArt also differ slightly from the general sample of all DCSs. The most common drug in this study population is MDMA, followed by cocaine, the first drug in the entire DCS system.

40.2% of participants are students, 38.8% were employed, followed by 10.8% unemployed and 9.3% high school students.

Behavioral intention

Drug checking results categorized by health risk, provide an insight into the Slovenian drug market and show the consistency of the results with the purchase. Based on the pre-defined categories (Table 1), 67.2% of sample results are consistent with purchase (category 1 – no additional risk), 5% of sample results show that the substance purchased is mixed with a lower amount of adulterants (category 2 – low additional risk), which does not pose a high additional risk to PWUD, 16.4% of sample results pose a higher health risk associated with added adulterants (category 3 – high additional risk) and 11.4% of samples were something other than what people had paid for (category 4 – very high additional risk) (n = 481).

In the "no additional risk" category, almost 90% of users confirmed their intention to use the sample and justified their decision based on possessing a desired substance, while 7.4% stated that they would not use it, mostly because they no longer possess the tested substances (n = 323).

For the 'low additional risk' samples tested (which accounted for 5% of the total sample), 58.3% of consumers stated that they intended to use the substance, citing the expected outcome as the most common reason for their decision, while 33.3% stated that they would not use the substance (n = 24[4]). The most common reason was the unexpected result of the analysis.

In the third category, in which we classified samples with a high risk to the participants' health, 40.5% of them indicated that they had no intention of consuming the substance, while 48.1% stated that they would consume it despite the result. In this category, samples of amphetamine with a higher proportion of caffeine and cocaine with a higher proportion of levamisole were found most frequently. For samples of amphetamine with caffeine, 30% of respondents stated that they would not consume the sample; for samples of cocaine with levamisole, this proportion was 70%. In 'very high additional risk' category 65.5% of participants stated that they would not use the tested substance if a substance other than the purchased one was detected, which is also the most common reason for their decision. Despite the unexpected results, 27.3% of respondents intended to use the substance. Similar effects between the tested and purchased substance or familiarity with the substance were most frequently cited as reasons for use. Predominantly among these samples were those purchased as the benzodiazepine alprazolam or LSD, but containing another type of benzodiazepine such as flualprazolam or an LSD analogue such as 1 P-LSD or 1 cP-LSD. Chi-square test ($\chi 2 = 142{,}79$, $p < 0{,}001$) showed a significant association between the test result of the health risk category and the behavioral intention following the test result. The riskier the tested sample is, the more users do not intend to use it.

In addition to deciding on the intention to use drugs, respondents were also asked about the reason for doing so. 306 open answers on various reasons for using or not using substance tests were analyzed. The answers were coded into 16 different categories. From 207 answers with a positive intention, 8 different sub-categories were identified, and other 8 sub-categories were identified from 76 answers with a negative intention. For each category, the number of responses and the specific responses were added. Respondents could give more than one reason for his decision to take drugs. The results for positive intentions are presented as an example in Table 2.

The categories with the most responses for negative intentions towards the use of drugs were "unexpected results" with

Table 2. The results of quality data analysis for positive intention toward drug use. Reasons for the intention to consume the purchased substance (additional explanation).

Reasons for the positive intention to use drugs (additional explanation)	Response examples	N	%
Expected result (PWUD indicate the consistency of the results with the purchase)	*"Because the result is okay."* *"Because it only contains substances that I want to use."* *"Because it contains nothing that I find objectionable."*	118	55,7
Purpose of use (PWUD indicate the purpose for which they will use the substance or opportunity in the future)	*"To explore one's own consciousness."* *"For relaxation."* *"When the opportunity arises."*	27	12,7
The possibility of exact dosage (The users indicate the possibility of dosing, depending on the purity of the substance)	*"I know the amount of active ingredients and can dose precisely."* *"Because there are no impurities and I can measure."*	24	11,3
Know the substance (PWUD claim to have received trustworthy information about the substance)	*"I know exactly what I have."* *"Because I know it's LSD."*	15	7,1
»Safe use« (PWUD state that no harmful adulterations are included)	*"Because it contains nothing harmful."* *"Because it contains no dangerous adulteration."*	13	6,1
Curiosity (PWUD indicate an interest in trying out the substance)	*"Because I am interested in the effects of substances."*	6	2,8
Possession of a substance (PWUD indicate that they have already purchased a substance)	*"We will not throw it away."*	5	2,4
Similar effects (PWUD indicate the similarity of the effects of the tested substance with the purchased substance)	*"The risk of ALD-52 is not significantly greater than that of LSD, although there is less information about the effect of ALD-52 on humans, this is not enough to stop me from using it."*	4	1,9
Total		212	100,

Table 3. The results of quality data analysis for negative intention toward drug use. Reasons not to consume the purchased substance (additional explanation).

Reasons for negative intention toward drug use (additional explanation)	Response examples	N	%
Unexpected result (Users cite the inconsistency of the analysis result with the purchase)	"Because it is 4-CMC, an unresearched substance." "Because the results are bad." "Because it is not strong enough + levamisole (supposed to be 90%)."	39	51,3
Substance is gone (Users cite that they no longer possess the tested substance or will pass it on)	"I don't have a sample anymore, I used it all for analysis."	11	14,5
Not using (Users cite that they currently don't use the substance, or never did)	"I tested for a friend." "Coincidentally I don't use it at the moment."	8	10,5
Poor quality (Users cite the low content of the active substance in the sample)	"Not pure enough, I expected 90%+ purity."	7	9,2
Health risk (Users cite additional health risk of the sample)	"Flubromazolam lasts too long and has too much influence on my physical abilities."	4	5,3
Other problems (Users cite bad experiences in the past, addiction)	"I don't feel good at the moment."	4	5,3
Alternative possibilities (Users cite the possibility of using another substance)	"I have a better-quality drug."	2	2,6
Inability to dose accurately	"I don't know how much active substance the unit contains."	1	1,3
Total		76	100

39 responses and example responses "Because it is 4-CMC, an unresearched substance" or "Because the results are bad." The next reason with 11 responses was that the substance had already been used or passed on with example responses "I have no more sample, I have used everything for the analysis"." The next reason (with 8 responses) was "not using", as PWUD state that they were not currently using the substance or had never used it, e.g. "I tested for a friend." Or "As it happens, I'm not using it at the moment"." The poor quality of the substance was the next reason for the negative intention to use drugs with 7 responses, e.g. "Not pure enough, I was expecting a 90%+ purity level" Other reasons with four or less responses were health risks, other problems (bad experiences, previous addiction), alternative options (they had the option to take another substance), and the inability to dose accurately. The results for negative intentions are shown in Table 3 as an example.

Behavior action

The first question in the follow-up to understand behavior actions toward drug use behavior two weeks after receiving the drug checking results was "What did you do with the tested substance". The results showed that 18.1% of participants had not yet done anything with the tested sample, 9.1% had thrown the sample away, one (1.8%) said they had returned it to the dealer and two (3.6%) said they had given it to someone else. 67.2% of participants had used the tested sample (n = 55). Of these, 56% reported a reduction in their usual dose, 37.8% reported no effect on their dosage and only 5.4% reported an increase in their regular dose (n = 37).

When we combine the risk-reducing outcomes of throwing away the sample, returning it to the dealer and reducing the dose into one risk-reducing behavior among those who reported any type of behavioral action, drug checking had a positive impact on reducing health risks in 64.4% of participants. In 31.1%, drug checking did not affect their drug use, while in 4.4% it had a negative effect, i.e. the person ingested a larger amount of the substance (n = 38).

Next, we assessed the behavioral measures according to the risk category of the sample (defined in Table 1). When the DC results were as expected (according to the substance purchased), 18 (81.8%) respondents reported consuming the tested substance, 3 users (13.6%) reported disposing of it (of which one returned the substance to the dealer, one threw it away and one gave it to another person). One of them did not take any behavioral action. (n = 23)

Only one sample was classified in low additional risk category, where respondents reported consuming the tested substance.

In 10 samples with high additional risk, 6 users reported using the substance, 3 rejected it and no change in behavior

could be detected in one sample. If the substance tested was a substance other than the one purchased, one user used the substance, one threw it away while no behavior could be observed in two cases, as the drug sample was still in their possession but use had not yet taken place at the time of the follow-up.

After removing 5 responses where no behavioral action had taken place, only 33 responses were included in the statistical analysis. Despite the ordinal variable of the additional health risk category, the chi-square test did not reveal a statistically significant ($\chi2 = 2.66$, $p < 0.05$) linear association between the perceived risk from the drug checking result and the change in behavioral action, as no data were available.

The chi-square test ($\chi2 = 19.54$, $p < 0.001$) confirmed that the behavior follows the behavioral intention. It is statistically significant that users who have the intention to throw away or consume the tested drug also perform the same type of behavioral action.

Of the respondents who intended to use the tested drug, 100% actually used it. Of those who did not intend to use the substance, 100% discarded the substance in some way. Those who have not yet decided whether to use the tested substance when they got the results, are more likely to use it.

Discussion

The aim of the study was to assess the ability of the Slovenian DCS of the DrogArt association to inducing a change in the clients' consumption behavior in order to reduce the health risks deriving from the unregulated drug market.

The data from the main sample shows that the information provided by a Slovenian DCS (DrogArt) induced a positive behavioral intention to avoid taking adulterated or unexpected drugs in almost a quarter (23%) of DCS users. The intention not to use a purchased substance increased to almost two-thirds (65.5%) when the results showed an unexpected substance. We can compare the results with the results of the recent study (Betzler et al., 2021), which showed similar results in terms of discharge of the sample with undesirable results in two thirds of the sample. The follow-up does not confirm the assertion in the segment of the samples with high additional risk, in which more than half of the service clients declared to have used the substance despite the high risk. However, when combining the risk-reducing outcomes (e.g. throwing away the sample or returning it to the dealer), DCS had a positive impact on reducing health risks.

The present study shows a strong correlation between the degree of health risk posed by the substance tested and attitudes towards drug use. The higher the health risk, the higher the intention to avoid use, showing that the strongest impact on PWUD is in situations where the risk of serious negative effects is greatest. This conclusion is also confirmed by the reasons for the PWUD decision, which were analyzed with the open question. The most common reason for not wanting to take the tested substance is an unexpected result ("the results are bad", "because it's not methylone"), poor quality ("not pure enough, I was expecting 90%+ purity") or a health risk ("flubromazolam lasts too long and has too much of an impact on my physical abilities"). To provide clients with this information to make a behavioral decision, a chemical analysis with tailored harm reduction advice and objective information about the potential health risk is required, as already stated in a previous study (Martins et al., 2015). If the sample in the Slovenian DCS system has a higher potency than is common on the illicit market, this information can be added to the results we provide to people and we add the harm reduction advice to minimize the risk.

It is not always the case that the intention not to consume the substance is due to health concerns. Almost 15% of respondents stated that the reason was that they had already consumed the substance before achieving results. In this case, the harm-reduction effect of DCS is not achieved, but it still provides an insight into their behavior and creates an opportunity to address this issue with them to encourage the use of DCS before taking drugs. Nonetheless, the use of DCS can be valuable for drug monitoring and harm reduction intervention (counselling) at the time of sample submission (Sande & Šabić, 2018).

If the intention to use the tested substance was positive, most respondents stated that they would use it because the result was consistent with the purchase or the risk posed by adulteration was not considered high enough to deter them from using it. It is important to acknowledge that the effects of DCS on behavioral intentions according to TRA (Fishbein & Ajzen, 1975) also depend on PWUD attitudes and subjective norms. To further enhance the positive effects on behavior, DCS should aim to incorporate people's attitudes and norms about drug use into the harm reduction intervention when they submit the sample.

The possibility of weak behavioral self-control among PWUD, especially those with a substance use disorder, could affect the link between behavioral intention and action. PWUD might claim after receiving the result that they do not intend to use the tested substance, but in other circumstances, such as at a party, they might still use the substance. The study confirms that recreational users act like rational subjects, able to evaluate costs and benefits related to their search for pleasure and to control they behaviors according to this evaluation (Measham, 2002; Parker, 2003) The study shows that there is a statistically significant relationship between behavioral intention and behavioral action in young recreational PWUD, making behavioral theory an appropriate framework for drug checking studies and DCS an effective harm reduction intervention with a direct positive impact on the behavioral action.

We were not able to directly demonstrate a change in behavioral action associated with the risk category of the drug sample, most likely due to the insufficient number of data collected, but we can indirectly demonstrate it based on a well-established assumption where actual behavioral change follows intention and the demonstrated influence of the risk category of the drug sample on behavioral intention.

With certain limitations we can compare the results to Valente (2022) and Measham (2021) regarding behavior action outcomes, thus closing the gap in scientific research evaluating the effectiveness of DCS. The aforementioned studies examined drug samples divided into an expected (sample

contains purchased substance) and an unexpected (sample does not contain purchased substance) category without considering the effects of adulteration on behavior change, but focusing on the impact of DCS on the adoption of different harm reduction strategies. By also considering the effects of adulteration, we were able to show that adulteration plays an important role in health risk perception and affects behavior change. This is only possible if drug checking methods are good enough to recognize different substances in a sample. This shows that advanced drug checking technology has a greater potential to influence the behavior of PWUD. This was one of the first study to examine an integrated, stationary and non-opiate specialized DCS (Karamouzian et al., 2018), whereas most previous studies have been conducted at festivals (Measham, 2019; Measham & Turnbull, 2021).

The study revealed the reasons behind the decision to use drugs after using the DCS, which can be used to further develop harm reduction drug checking intervention guidelines for drug checking, filling the gaps in current scientific research and bringing the DCS one step closer to an evidence-based service. Our results seem to confirm previous findings (Measham, 2021; Valente, 2022) as they support the concept that DCS can act as a risk reduction tool and influence behavior change in different user groups (recreational users and people who inject drugs) (Karamouzian et al., 2018; Measham & Turnbull, 2021; Valente, 2022). From the results of our study, we can also confirm that the integrated approach has the potential to provide PWUD with counselling interventions, which in our case was provided to 389 service users.

PWUD are often seen as passive people who are unable to regulate their consumption because they are stigmatized and that they are homogeneous category. Among PWUDs there are also socially integrated people who are able to apply self-control strategies to reconcile their drug use with their work and social engagement and to reduce health risks (Cruz, 2015; Moore et al., 2011; Parker, 2003).

When given the opportunity to make an informed decision through a non-judgmental, anonymous DCS, we see them as rational subjects making a positive behavior change to reduce health risks. Positive change means avoiding the use of adulterated or unexpected drugs or reducing the dose of strong drugs to reduce health risk. As the drug market can be very unpredictable and very dangerous, even life-threatening substances appear all the time, DCS that influence behavior can save lives.

Although DCS continue to provoke controversy due to the moral view of drug use (Marlatt, 1998), which hinders their implementation across Europe, the overall concept that evidence-based harm reduction interventions are an important part of a balanced drug policy is widely accepted (EMCDDA, 2023) and DCS should be part of an integrated health strategy due to their potential to reduce risks among PWUD.

Limitations of the study result from the very low response rate in the follow-up surveys and the difficulty of ensuring anonymity while still linking the sample to the individual responses. Due to the lack of follow-up data, it was not possible to show direct changes in behavior according to the risk category of the sample. Nevertheless, the results can serve as a good basis for continuous data collection and further evaluation of DCS. Limitations also include those of the theoretical approach, as it focuses on behavioral intentions without considering the broader social context and other possible influences such as unconscious influences and the role of emotions on behavior (Sniehotta et al., 2014). Furthermore, there are more complex ways in which PWUD can take less risky actions towards drug use than using or not using the substance or using smaller amounts or throwing the drug away. It would also be good to know how behavioral outcomes vary depending on the strength or adulteration of the substance tested. One of the main obstacles in the study was the high dropout rate in the follow-up study. We understand that this was due to fear of loss of anonymity (as the sample code was linked to the persons, although anonymity was guaranteed). Perhaps this was also the reason why some of them did not agree to the informed consent. The system with the sample code was also less clear to respondents, as a large proportion of them gave the wrong or non-existent sample code. The 14-day period between the results and the follow-up may also have been too long for respondents. If we were to repeat such a study, we would revise the follow-up system to give respondents more certainty about anonymity and make it easier for them to respond with the sample codes.

Notes

1. We refer to a community based DCS as an integrated service in the harm reduction organisation, where PWUD submit a small portion of the drug sample for quantitative analysis and receives the results. This integrated approach also provides brief counselling at the time the sample is submitted and information about the risks once the results are known and it can be distinguished from drug checking on festivals or clubs. Not all DCS provide quantitative results, as it depends on the equipment used and the substances beeing checked and on the time from sample submission to the results.
2. PWUD can bring the samples to the service without providing personal data.
3. We conducted this part of the study only at the DCS infopoint DrogArt (one of seven DCS infopoints in Slovenia) with the largest reach and the most samples collected per year.
4. Numerus for the entire category 2 »low additional risk«.
5. Non-dangerous substances were also categorised in this category, as there is a possibility that a false feeling about the purchased substance may arise.

Availability of data and materials

The data used for this study is not publicly available. For further information on the data and materials used in this study, please contact the corresponding author.

Disclosure statement

The authors report there are no competing interests to declare.

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