European Monitoring Centre
for Drugs and Drug Addiction

MONITORING DRUG USE IN THE DIGITAL AGE: STUDIES IN WEB SURVEYS

The potential for using web surveys to investigate drug sales through cryptomarkets on the darknet

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Abstract: Over the last decade, drug sales through cryptomarkets located on the so-called darknet have received increasing attention. This paper considers how web surveys might be used to provide insights concerning those people who purchase drugs on cryptomarkets. First, it analyses data from the European Web Survey on Drugs (EWSD), with a view to identifying differences between respondents who buy drugs on cryptomarkets and those who acquire drugs from other sources. The study shows that people using cryptomarkets as a usual source of supply were a small group of users in most participating countries, but that proportions differ significantly, and that buyers were more likely to be male and consume more substances on average. Second, the sampling of web survey respondents on the darknet is discussed based on a sampling strategy tested in Austria, highlighting the challenges and opportunities involved in undertaking survey recruitment on the darknet. The paper highlights the importance of building trust, establishing credibility and guaranteeing anonymity, since awareness of privacy issues is seemingly higher among darknet users than surface web users. By doing so, the authors shows how people who buy drugs on cryptomarkets might be reached to improve their representation in future web surveys for drug data collection.

Introduction

Over the last decade, new internet technologies have acted as important facilitators of online drug markets (EMCDDA, 2016). In particular, drug sales through cryptomarkets ([1]) located on the so-called darknet have received increasing attention.

At present, estimated darknet sales seemingly account for a minority of all drug sales in Europe (EMCDDA and Europol, 2019). Findings from the European Web Survey on Drugs (EWSD) highlighted in this paper also show a relatively small proportion of all respondents using such markets to purchase drugs. However, darknet sales vary considerably for different substances and also between countries. In 2019, among all illicit substances sold, cocaine was reported to generate the most revenue for anonymised darknet dealers, with small consignments often sent directly to end users across the European Union using post and parcel services (EMCDDA and Europol, 2019). By contrast, there is evidence that for MDMA/ecstasy, purchases on the darknet are more likely to be intended for onward sale on local drug retail markets (EMCDDA and Europol, 2017, 2019). More recently, the darknet has also played an increasing role in the distribution of fentanyl derivatives (EMCDDA and Europol, 2019).

([1]) In this paper, 'cryptomarkets' refer to virtual platforms for the exchange of products and services that exist on the 'darknet' — a portion of the internet that is not accessible without the use of specialised web browsers or software, which distinguishes it from the open part of the internet (also known as the 'surface web'). See for example EMCDDA (2016) for further information on the various types of markets that exist for the buying and selling of drugs on the internet.

While some studies among the customers of darknet markets have been conducted on the *perception* of safety, convenience, pricing and quality (e.g. Bancroft and Scott Reid, 2016; Barratt et al., 2013, 2016), research on the characteristics of people who use such markets to acquire drugs for their own personal use has been limited. An Australian study found that respondents who purchased drugs on the darknet used a greater number of drugs compared to non-darknet users, although the sample size of darknet users was small (Van Buskirk et al., 2016). More recently, the EWSD and other similar surveys involving large numbers of people who use drugs have begun to shed further light on the characteristics of darknet users (see for example, Caulkins et al., 2022 and Vuolo and Matias, 2020). For example, according to the Global Drug Survey (Winstock et al., 2017), people who purchase drugs on the darknet are more likely to be relatively young, male and associated with a clubbing scene.

This paper considers two different ways in which web surveys might be used to provide insights concerning those people who purchase drugs on cryptomarkets. First, data from the second wave of the EWSD are analysed with a view to identifying differences between respondents who buy drugs on cryptomarkets and those who acquire drugs from other sources (e.g. from a dealer or through sharing with friends). Second, the sampling of web survey respondents on the darknet is discussed based on a sampling strategy tested in Austria, highlighting the challenges and opportunities involved in undertaking survey recruitment on the darknet. This pilot project was undertaken through placing an identical German-language version of the EWSD questionnaire on a darknet webpage and promoting the survey through various darknet forums and marketplaces. The aims of this paper are twofold. On one hand, it seeks to examine whether the EWSD is able to gather information on the characteristics of people who predominantly buy drugs through cryptomarkets, and, on the other hand, to show how this group of people might be reached to improve their representation in future web surveys for drug data collection.

Quantitative analyses based on the international data set

Sample and methods

Data was used from all 10 countries [2] participating in the second wave of the European Web Survey on Drugs (EWSD, 2017–2018), with a total of 30 339 respondents. From this sample, 20 157 respondents provided valid answers on their usual source of drugs and were used for further analyses. Out of these, 1 559 respondents (7.7 % of valid responses) reported

using cryptomarkets as a source for any drug included in the questionnaire. Despite this relatively large number of people using cryptomarkets among other sources in the total sample, it is important to note that this figure was very low in some countries and for some specific drug types.

The percentage of respondents who reported buying drugs on cryptomarkets is broken down by country and by substance. The basic characteristics (gender, age, place of residence, number of substances used in their lifetime) of the respondents who reported using cryptomarkets and those who do not source drugs in this way are compared on the country level to assess whether patterns are similar or different across countries. All analyses presented in this paper are based on bivariate analyses, and therefore confounding by other variables cannot be ruled out. Multivariate analyses presented elsewhere (Strizek et al., 2020) [3] revealed a significant association between whether respondents use cryptomarkets or not and their gender, age, place of residence and the number of substances used in their lifetime. As with other evaluations based on non-representative samples, the transferability of results presented in this paper is limited by the selectivity of the sample.

The use of cryptomarkets among different sources for acquiring drugs

Separate questions relate to the *usual* sources of supply for each substance covered in the EWSD [4] (that had been consumed in the last 12 months) using multi-response options. In other words, the responses are not mutually exclusive. Therefore, when a respondent indicated that they usually purchase on cryptomarkets, this response can represent one among other sources. Therefore, several sources of supply for one substance and different sources for different substances can be determined.

Figure 1 shows the distribution of responses on usual sources of supply for all respondents and across all substances. The number of respondents who stated that they usually use cryptomarkets to acquire a specific drug they had used in the last 12 months was 1 559. Out of these, 86.3 % usually also use other sources for acquiring their drugs (n = 1 345, or 6.7 % of all valid responses), and only a small proportion (13.7 %) exclusively use cryptomarkets (n = 214, or 1.1 % of all valid responses). The vast majority of respondents never use cryptomarkets (18 598 respondents or 92.3 % of all valid responses). By far the most common sources of drug acquisition reported in the EWSD are being 'given drugs for free/sharing

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[2] Austria, Belgium, Cyprus, Estonia, Finland, Italy, Latvia, Lithuania, Luxembourg and Poland.

[3] Several of the tables and figures presented in this paper have been adapted from their original published versions (Strizek et al., 2020).

[4] The data set provides information on the usual sources of supply of cannabis (resin and weed), cocaine (powder), ecstasy/MDMA, amphetamine (speed), methamphetamine and NPS (herbal mixtures, tablets/crystal, liquids, blotters). Usual sources of supply for fentanyl and buprenorphine were excluded from the analyses because the corresponding modules were not used in all countries and only very few valid responses were available.

FIGURE 1

Usual sources of supply for all respondents across all substances (multi-response options, overall valid answers = 20 157)
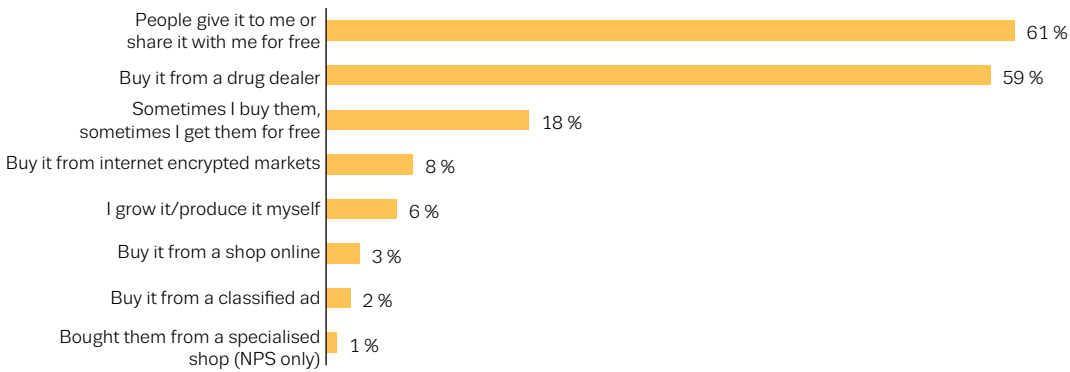
with friends' or 'buying from drug dealers' (with 61 % and 59 % of respondents reporting the use of these sources of drug acquisition respectively). Notably, more respondents reported using cryptomarkets than growing/producing their drugs themselves ('I grow it/produce it myself') or purchasing them on the surface web ('Buy it from a shop online').

It should be noted that approximately one third of eligible respondents (*n* = 10 182) failed to provide valid answers to questions about their usual sources of supply. Comments in open questions indicate that this was done for reasons of confidentiality (e.g. as shown in answers like 'none of your business') or because they felt that the relevant answer categories were missing (e.g. answers such as 'bought in a coffeeshop in the Netherlands' or 'bought from friends').

Country-level and substance-type differences in the use of cryptomarkets

Broken down by country, Figure 2 shows that the number of respondents using cryptomarkets for their drug supply is consistently low in all participating countries, with the notable exception of Finland, where 23 % of all respondents providing valid answers to such questions report usually buying on cryptomarkets, followed by Poland at 10.8 % (Figure 2). This exceptionally high popularity of cryptomarkets in Finland corresponds with similar results presented in recent Global Drug Survey reporting (Winstock et al., 2018).

Looking at individual substances, the percentage of respondents usually using cryptomarkets to acquire drugs

FIGURE 2

Number and percentage of respondents who report usually buying on cryptomarkets by country
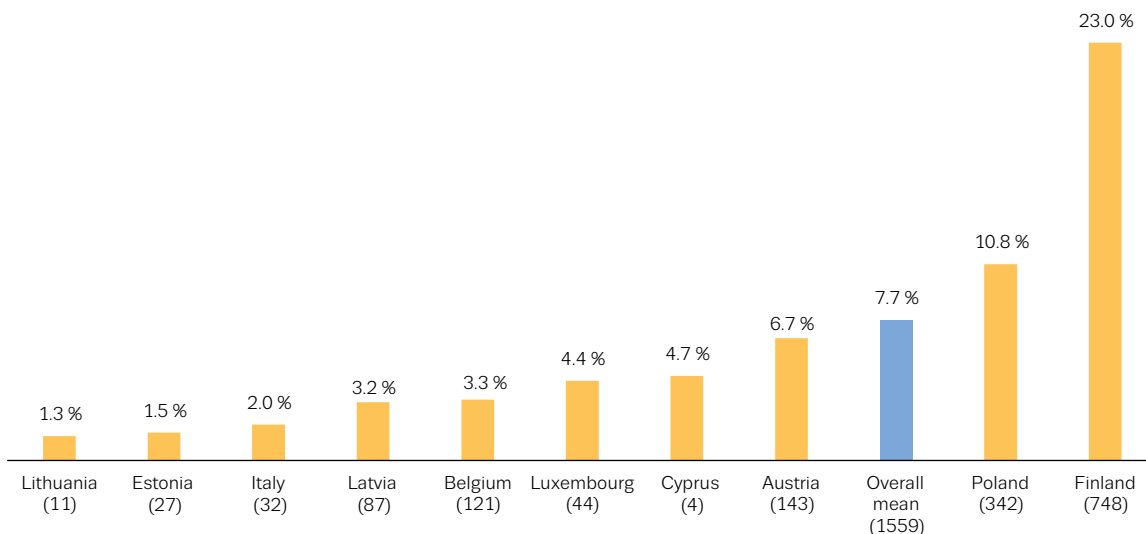
The first number above the bar signifies the number of respondents while the second number denotes the percentage of respondents that this number represents out of each country's total valid responses. For example, in Luxembourg 44 respondents reported that they usually buy a specific substance on cryptomarkets, which represents 4.4 % out of all valid respondents in Luxembourg who provided data on where they acquire their drugs from. The orange bar represents the total number of respondents and the overall mean across all countries.

TABLE 1

Purchasers using cryptomarkets by substance

	Usually buy on cryptomarkets (valid percentage)	Total number of respondents reporting buying the listed substances through cryptomarkets	Total number of respondents providing valid answers
NPS (powder)	27.2	308	1 131
NPS (herbal)	13.5	51	379
NPS (blotters)	12.1	28	232
NPS (liquid)	9.6	10	104
Methamphetamine	9.3	88	942
Ecstasy/MDMA	8.3	516	6 229
Amphetamine	6.9	289	4 189
Cannabis resin	4.8	256	5 347
Cannabis herbal	4.1	702	16 928
Cocaine	3.3	145	4 418

varies considerably. As seen in Table 1, this ranges from 27.2 % of all users of new psychoactive substances (NPS) in the form of powders to 3.3 % of cocaine users. Thus, based on EWSD data collected from a large self-selected sample of people who use drugs, in relative terms cryptomarkets seem to be more important for drugs that are used by fewer people and less important for drugs that are generally more well-established, such as cannabis or cocaine. At least this appears to be the case at the retail level, since this is the level at which the EWSD seemingly collects data on drug purchases. However, some caution should be exercised when interpreting these results, as the sample sizes for some substances are very small (e.g. for NPS liquids and blotters).

Characteristics of cryptomarket users

Table 2 shows the association between the use of cryptomarkets and respondents' gender and whether they live in rural (village) or urban areas (town/city), respectively, for the countries covered in the EWSD. In 6 out of 10 countries males are more likely to use cryptomarkets than females (OR > 1), while in the remaining four countries no significant association between gender and the use of cryptomarkets can be seen. Further, the EWSD shows that respondents making use of cryptomarkets are not more likely to live in villages than in towns/cities.

TABLE 2

Association on country level between the use of cryptomarkets and gender and living in a village or a town/city

	Gender				Living in rural or urban areas			
	n	Users of cryptomarkets among males (%)	Users of cryptomarkets among females (%)	OR (CI)	n	Users of cryptomarkets in villages (%)	Users of cryptomarkets in towns/cities (%)	OR (CI)
Austria	2 099	8.5	3.4	2.6 (1.7–4.0)	1 683	7.3	6.9	0.9 (0.6–1.4)
Belgium	3 609	4.6	1.3	3.5 (2.1–5.9)	3 042	2.8	3.3	1.2 (0.8–1.8)
Finland	3 193	25.6	15.7	1.8 (1.5–2.3)	2 813	17.6	23.2	1.4 (1.0–1.9)
Latvia	2 680	3.9	1.1	3.8 (1.9–7.6)	2 335	2.6	3.2	1.3 (0.5–3.2)
Poland	3 146	10.5	11.0	1.0 (0.8–1.2)	2 511	7.9	12.3	1.6 (1.1–2.5)
Cyprus	85	4.8	4.5	1.1 (0.1–10.7)	79	8.3	3.0	0.3 (0.0–4.1)
Estonia	1 720	2.0	0.7	2.9 (1.0–8.5)	1 548	0.0	1.7	1.0 (−)
Italy	1 617	1.9	2.1	0.9 (0.4–2.1)	1 452	1.8	2.0	1.1 (0.3–3.7)
Lithuania	809	2.1	0.5	4.2 (0.9–19.5)	683	0.0	1.1	1.0 (−)
Luxembourg	994	5.7	1.0	5.8 (1.8–19.1)	874	3.6	4.1	1.1 (0.6–2.3)
Total	**19 952**	**8.9**	**5.3**	**1.7 (1.5–2.0)**	**17 020**	**5.6**	**8.2**	**1.5 (1.3–1.8)**

OR (CI), odds ratio with confidence interval in brackets; OR < 1 indicates a positive association between gender/place of living and the probability of being a user of cryptomarkets or not; n = number of valid responses. The total number of valid responses is reduced from the total providing valid responses on the question related to sources of supply due to missing data for gender or place of living. The table has been adapted from Strizek et al. (2020), where it was first published.

TABLE 3
Mean difference on country level for age and number of substances used (lifetime) between users of cryptomarkets and non-users of cryptomarkets

	Age				Number of substances in lifetime			
	n	Mean (users of cryptomarkets)	Mean difference (compared with non-users of cryptomarkets)	Sig.	n	Mean (users of cryptomarkets)	Mean difference (compared with non-users of cryptomarkets)	Sig.
Austria	2 126	23.0	0.2	–	2 126	8.7	2.1	**
Belgium	3 623	27.6	0.0	–	3 623	8.1	2.6	**
Finland	3 184	24.7	−3.2	**	3 256	7.3	1.1	**
Latvia	2 678	25.1	0.2	–	2 709	7.7	2.6	**
Poland	3 167	23.9	0.1	–	3 167	8.5	2.5	**
Cyprus	86	24.5	−5.1	–	86	7.0	2.3	–
Estonia	1 738	24.4	−2.0	*	1 749	7.1	1.4	*
Italy	1 592	23.4	−1.1	–	1 622	6.8	2.6	**
Lithuania	808	23.6	0.6	–	815	9.8	4.8	*
Luxembourg	980	25.6	0.0	–	1 004	7.4	3.3	**
Total	**19 982**	**24.6**	**−0.9**	****	**20 157**	**7.8**	**2.2**	****

Mean differences with a negative value indicate that users of cryptomarkets score lower for that value than non-darknet users. Sig, significance; *n*, number of valid responses; * indicates significant differences for t-test on 0.05 level of significance; ** indicates significant differences for t-tests on 0.003 level (adjusted for Bonferroni); – indicates no significant difference. The total number of valid responses is reduced due to missing data for age. The table has been adapted from Strizek et al. (2020), where it was first published.

For all respondents providing valid answers to the question on their sources of supply, the differences between those who stated that they usually made use of cryptomarkets (for any drug included in the questionnaire) and those who would not normally buy drugs in this way are displayed in Table 3. In all countries, respondents using cryptomarkets reported a higher number of drugs used in their lifetime. This association is significant in all but one country (Cyprus, which had a very small sample size *n* = 86). Age differences between users and non-users of cryptomarkets are very small and do not show a consistent trend across countries.

Qualitative insights from piloting the EWSD on the darknet

The EWSD, in line with other surveys, found that a comparatively small proportion of the self-selected sample sourced their drugs from cryptomarkets. This raises the question of whether this group of people is truly small or whether conventional web surveys placed on the surface web fail to reach them. Therefore, besides the Austrian version of the EWSD that was sited on the surface web and promoted via Facebook (which resulted in the data included in the quantitative analysis used for this paper), an additional recruitment strategy was piloted. A copy of the EWSD with identical questions was placed on a .onion-page on the darknet and advertised on darknet-pages (cryptomarkets, forums and vendor shops). The survey was set up in German

and not specifically targeted at Austrian-based darknet users, but open to all German-speaking users. The advantages and pitfalls of this specific approach and the lessons learned are discussed in the following sub-sections. Our considerations were informed by valuable feedback collected from cooperative darknet webpage administrators after the survey was conducted. In total, five administrators (referred to in the text as [A1–5]) from cryptomarkets, forums and vendor shops responded to our feedback request via e-mail or the contact form on their pages.

Preparations to reach people through surveys on the darknet

Placing a survey on the darknet requires some preparatory steps. Technical preparations included the installation of a web server that was accessible through the TOR ('The Onion Router') network and the setting up of the survey on a Hidden Service. Hidden Service addresses end in .onion URLs and can only be accessed via the TOR network and not through conventional internet browsers via the surface web. A German version of the EWSD was used and promotion was only carried out in German.

To enhance anonymity and security, the use of encryption software was a necessary and useful tool to communicate with the darknet community and to make contact with cryptomarkets, vendor shops [5] or forums. The most frequently used way to encrypt communication is via PGP ('pretty good privacy')

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[5] Unlike cryptomarkets, vendor shops are operated by a single vendor or a small group of vendors.

encryption. In practice, PGP encryption was often necessary to create accounts, access darknet forums and contact administrators/moderators. Additionally, the permission and support of administrators or moderators of cryptomarkets and forums was frequently required in order to promote the survey. In one case, for example, support from a forum host resulted in them placing a banner for the survey on the forum page.

Lessons learned from the approach

After running the survey for five consecutive weeks and ensuring constant visibility on darknet pages through regular contact with administrators, the response rates were still too low for quantitative statistical analyses. While 990 clicks on the first information page were registered, only 53 users started the survey and 25 completed it. In addition to the high importance of privacy and anonymity among darknet users (Mirea et al., 2019) who might initially be at odds with participating in a web survey about personal drug use behaviour, restricting the survey language to German might have hindered some darknet users from participating.

Qualitative data gathered from users and through communicating with forum-, market- and shop-administrators and moderators provide insights into the dynamics of placing a survey on, and generating respondents from, the darknet, and may help to improve the implementation of similar projects in the future.

Time and patience: Darknet pages are subject to frequent changes with regard to .onion URLs and accessibility. Intensive research is needed to discover current URLs and to check pages' eligibility in terms of advertisements; for example, in our case this meant looking for pages with drug-related content that were accessible in terms of advertisements, showed user activity and were conducted in German or English. Connection via the TOR-browser is often slower than that experienced on conventional browsers, due in part to the connection routes passing through several relays. Login procedures can require multiple steps and may take several minutes and consecutive attempts. This process has implications for the possibility of using media files (e.g. videos) in the survey, which may take a very long time to load, for promotional issues and also for the total length of the survey.

Providing anonymity and using encryption: Members of darknet communities are especially aware of privacy issues and potential law enforcement surveillance. While not all darknet users encrypt their communication due to these issues, it is generally referred to as 'good practice' within the community of darknet users (Aldridge and Askew, 2017). Overall, our contact with forum administrators during the preparation for the survey suggested that the use of encryption is a necessary tool to communicate with the darknet community and in order to gain

access to markets and forums. Consequently, it is important to be prepared for the use of encryption to communicate with the darknet community and access specific sites, and thus gaining proficiency in using encryption before making these connections is crucial. With regard to issues around anonymity and confidentiality, an administrator of a harm reduction forum on the darknet explained that 'in general the darknet community are less open to participating in studies than mainstream surface web communities such as Reddit, Bluelight etc.' [A1]. While it may be sufficient to place a survey on the surface web and encourage and enable access via the darknet and the TOR network, feedback from administrators was in favour of placing the survey on the darknet. As stated by one administrator, 'If you are advertising the study on .onion sites, then it is certainly worth it to have a .onion address for people to do the study on, that would be a big plus for them' [A1].

Credibility and trust: To successfully recruit respondents from darknet communities, credibility and trust have to be established. It thus appears to be necessary to have a recognisable name as an organisation or researcher and to provide authentication on request. An example from correspondence with a forum administrator illustrates this issue. As they stated, 'I would also like to see some type of confirmation that this [the survey] is by Checkit, for example if you have an email address @checkit.wien or a colleague does, so they can just send me an email so I know it is a study by you' [A2]. Another administrator proposed that credibility could be bolstered and authentication provided in other ways, such as 'links to pages displaying the researcher's bio/CV/ etc. Proof that the person I'm sending messages to is indeed the person on the web page' [A2]. Trust might also be gained through recommendations or referrals from other people on the darknet. Precautions suggested by an administrator included, 'Being recommended by [the] owner of larger marketplaces for example and proving that users are not talking to the police' [A3].

Getting in touch early: Recruiting participants for a survey in darknet forums generally requires the permission of the person in charge, for example the administrator or moderator. To ensure there is enough time for the clarification of all potentially arising questions before data collection, getting in touch with such a person well ahead of time, in terms of implementing the survey, is important.

Language: The use of German in our survey was likely a major constraint to reaching a bigger sample. Thus, offering the survey in English and other languages, and asking for country of origin, would potentially lead to a higher response rate.

Conclusions

In line with the findings of other surveys on this topic, the data from the European Web Survey on Drugs (EWSD) indicate that people using cryptomarkets as a usual source of supply are a very small group of users in most participating countries. However, proportions differ significantly between countries; for example, the survey found a notably higher proportion of cryptomarket users in Finland. In relative terms, when users of different substances are compared, EWSD data indicated that a high proportion of respondents using certain new psychoactive substances reported purchasing these on cryptomarkets, particularly in relation to NPS powders. However, the small number of respondents means that further research in this area is needed.

There are several key findings from this study. First, cryptomarkets are used by a relatively small segment of all EWSD respondents. Most respondents who used cryptomarkets also used other sources of supply and nine out of ten respondents never bought drugs on cryptomarkets. Second, buyers on cryptomarkets were more likely to be male and consume more substances on average. By contrast, bivariate analyses did not show substantial differences from other purchasers in terms of age or area of residence (rural or urban). Third, the recruitment of respondents from the darknet remains challenging and calls for specific techniques and procedures. Particular attention should be paid to building trust, establishing credibility and guaranteeing anonymity, since awareness of privacy issues is seemingly higher among darknet users than surface web users.

The EWSD has shown that it is possible to collect data from a sample of people who use drugs and who report purchasing drugs on cryptomarkets. However, it is quite conceivable that the EWSD and other similar web surveys for drug data collection carried out on the surface web are only reaching a particular subset of this group of people. This is an area in which further research is needed to build on the lessons learned in this study, including the development of better questions for obtaining information on the ways in which people acquire drugs and to understand the motivations for their different choices in terms of sources of supply. Online surveys have considerable potential in this area due to their ability to reach large numbers of respondents quickly, but it is important to further improve our understanding of how different recruitment methods can better reach diverse groups of people who use drugs.

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EMCDDA Insights are topic-based reports that bring together current research and study findings on a particular issue in the drugs field. This paper is published as part of *Monitoring Drug Use in the Digital Age: Studies in Web Surveys*, an EMCDDA Insights that provides an overview of current knowledge and the latest developments in the field of web surveys on drug topics. The Insights contains in-depth reports on the methodology of web surveys, the available studies being carried out in different drug topics and analyses of the European Web Survey on Drugs. The Insights will be of interest to researchers and scientists, people who use drugs, policymakers and their advisors, specialists and practitioners, and all those concerned with the issue of drugs and innovative methods.

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