



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

Web surveys as a method for collecting information on patterns of drug use and supply

Vendula Belackova^a and Eva Drapalova^b

^a Social Policy Research Centre, Faculty of Arts, University of New South Wales, Sydney, Australia

^b Department of Addictology, 1st Faculty of Medicine, Charles University in Prague and
General Teaching Hospital in Prague, Prague, Czech Republic

Abstract: The online space has emerged as a promising avenue for conducting surveys and identifying trends in illicit drug use, as information can be collected quickly and cheaply from large numbers of people who use drugs, providing an opportunity to fill important knowledge gaps about how drugs are used. This study reviews the existing literature around online survey methods and their specific application in the area of drug use, looking at their main advantages, drawbacks, limitations and areas for further development. By providing respondents with a sense of anonymity and privacy, web surveys may be particularly useful for obtaining information on sensitive topics like drug use. Drawbacks of web surveys include sometimes having high levels of item non-response and incompleteness, and that respondents may be prone to 'satisficing bias'. One of the main limitations of these surveys is that they are usually not representative of the general population or of any pre-defined populations of people who use drugs. Nevertheless, self-selected online drug surveys remain an important tool for collecting data from hidden populations of people who use drugs. They can provide in-depth insights into patterns, practices and features of drug use and drug markets, and the relationships between these variables.

Background

The online space is increasingly important in identifying trends in illicit drug use (Deluca et al., 2012; Schifano et al., 2005; van Amsterdam et al., 2015). As with many social and buying behaviours, drug-related social interactions and acquisitions have partially moved online, with new psychoactive substances now available in online shops (Belackova et al., 2018; Brunt et al., 2017; Curtis et al., 2015; EMCDDA, 2011), and darknet marketplaces offering both licit and illicit drugs (Barratt and Aldridge, 2016; van der Gouwe et al., 2017; Van Hout and Bingham, 2013). At the same time, the internet has emerged as a promising avenue for conducting surveys, as information can be collected quickly and cheaply from large numbers of people who use illicit drugs, thus providing an opportunity to fill important gaps in our knowledge about how drugs are used, particularly by recreational users.

The use of web surveys for drug-related research and monitoring has been increasing and diversifying, but, as with any research method, this approach has both strengths and limitations. This paper, therefore, seeks to take stock of recent work in this field and highlight the potential benefits of this methodology, alongside its limitations and areas for further development, to maximise the usefulness of such studies. Examples of web surveys for drug data collection will be covered in the other papers in this collection, and more information on these can be found in the [Introduction](#).

Web-based surveys are self-administered electronic questionnaires accessible online on the internet. Participants can be invited to take part both online (e.g. through web ads on social media or online forums, or through mailing lists) and offline (e.g. at nightlife venues or events). These surveys are successors to the previously developed computer-assisted survey methods. Computer-assisted telephone interviewing (CATI), personal interviewing (CAPI) or self-interviewing (CASI) have yielded multiple advantages over 'pen and pencil' questionnaires in terms of built-in data-quality checks or the ease of incorporating audio-visual materials in the survey (Skarupova, 2014). Widespread use of the internet has moved computer-assisted surveys into the online space, providing access to large groups of potential respondents (Callegaro et al., 2015). Yet, there are both advantages and limitations to online survey methods.

This paper provides a narrative review of the existing literature around online survey methods and their specific application in the area of illicit drug use. A search of relevant databases (Google Scholar, EBSCO, ProQuest) was conducted in order to gather information relating to the main advantages and drawbacks of online surveys, including their technological properties and sampling, which are described in turn below.

Web survey technologies: advantages and drawbacks

Web survey technologies have many benefits. These include the potential for efficiently scaling up surveys and providing a greater sense of confidentiality than other survey methods. Similar to other computer-assisted survey methods, online surveys have technical features that can improve data quality. In addition, online surveys are now broadly available to researchers at a relatively low cost and can reach large groups of respondents. There are some limitations to online survey technologies too, mainly pertaining to the absence of an interviewer — although, as discussed below, this has also yielded some advantages in relation to reducing social-desirability bias.

Advantages of web survey technologies

Web surveys are generally more cost-effective than other methods (Hunter et al., 2013) as a result of reduced response times, fast data processing, and savings in the time and cost of interviewers or data transcription (Beebe et al., 1997; Rosenfeld and Booth-Kewley, 1993). In other words, the technology has made 'survey data collection ... available to the masses' (Couper, 2000). As is apparent from the overview

of drug surveys listed above, web surveys have proven to be particularly attractive for conducting cross-national studies. Respondents can fill them in when and where they want, with the additional ease of using mobile devices. Web surveys give the researcher with limited resources flexible access to large numbers of respondents from diverse locations in a short time period (Barratt and Lenton, 2015; Brick, 2015; Gosling et al., 2004).

Web surveys may be particularly useful for obtaining information on sensitive topics like illicit drug use, as they can provide respondents with a sense of anonymity and privacy (Burkill et al., 2016; Miller and Sønderlund, 2010). Some studies have demonstrated that respondents are more likely to disclose their tobacco and alcohol use patterns via a web survey than through self-administered paper questionnaires (Lygidakis et al., 2010), although other research found web surveys comparable to self-administered paper questionnaires (Dodou and de Winter, 2014). The absence of an interviewer or facilitator in web surveys seems to reduce social-desirability bias: that is, it decreases the likelihood that respondents over-report socially approved behaviours and under-report those that are considered socially undesirable or are stigmatised (Krumpal, 2013). Studies have shown such bias to be lowest in web surveys and highest in phone interviews (Chang and Krosnick, 2009; Holbrook et al., 2003; Kreuter et al., 2009). Guaranteeing privacy and confidentiality are central to reducing social-desirability and other biases; therefore, providing assurance to respondents that survey responses will not be tracked in terms of internet protocol (IP) addresses or any other potentially identifiable details is an important step in web surveys on sensitive issues (Barratt and Lenton, 2015).

The technical properties of web surveys, as is the case for computer-assisted survey methods generally, have the benefit of built-in data-quality checks. Web surveys have variable functions that can help reduce the duration of the survey through skip patterns, and they can improve the data's validity with interactive features and range checks. In addition, the technology can prevent missing or incorrectly formulated answers and can readily provide additional information about survey completion (Granello and Wheaton, 2004). This additional information, also known as paradata, can assist in tracking respondents' behaviour throughout the survey (Gummer and Roßmann, 2014; Kreuter, 2013; Mayerl, 2013). For instance, a longer response time might indicate that respondents have difficulty understanding a particular question (Callegaro et al., 2009), that some questions require more cognitive effort due to their complexity (Bassili and Scott, 1996; Yan and Tourangeau, 2008) or that respondents might not be comfortable with a particular question (Bassili and Scott, 1996; Heerwegh and Loosveldt, 2006). In the case of drug surveys, a longer response time might be due to questions that use expert terms unfamiliar to respondents

or which require respondents to recall past drug use or give an estimation of drug quantities, or as a result of requests for personal information regarding the context of drug use and drug acquisition.

Web survey drawbacks

While they have many advantages, web surveys also have limitations. First, web-based questionnaires sometimes have high levels of item non-response and incompleteness (Heiervang and Goodman, 2011) and contain a higher rate of 'don't know' and otherwise ambiguous responses (Heerwegh and Loosveldt, 2008). Higher drop-out rates result from the depersonalised nature of online studies and respondents feeling relatively little personal involvement in the research (Murray, 2007; West et al., 2006). Also, there is generally no one available to explain the questions, provide reassurance about confidentiality and, overall, keep respondents motivated to fill in all the questions and complete the survey (Couper, 2000). Certain types of questions may increase the drop-out rate, such as open-ended questions placed early in the survey or repeatedly in one sequence (Crawford et al., 2001). On the other hand, built-in technical controls that remind respondents of unanswered questions or that do not allow further progression in the survey unless an answer is provided can result in a lower number of missing responses than would be the case in paper-based self-completion surveys (Lygidakis et al., 2010; Russell et al., 2010). However, too many incorporated checks may lead to higher drop-out rates, implying that there may be a trade-off between low drop-out rates and fewer missing responses.

Second, respondents might be prone to 'satisficing bias'. Rather than providing the true answer, the satisficing decision-making strategy can manifest in surveys as a tendency to indicate an answer that seems most likely to be correct (and is often inaccurate). Respondents who answer in this manner are more inclined to finish the survey by answering all the questions in a relatively short amount of time, rather than providing the most accurate answers, which requires more cognitive effort. According to Fang et al., satisficing is the main reason for discordant answers between paper and web surveys (Fang et al., 2014). Some studies suggest that the best indicator of 'satisficing' may be a short response time (Barge and Gehlbach, 2012; Callegaro et al., 2009; Greszki et al., 2015; Zhang and Conrad, 2014), but other researchers suggest this may not be the case (Harms et al., 2017; Lenzner et al., 2010). Removing short-response-time answers from a data set could be one way of improving data quality (Conrad et al., 2017; Greszki et al., 2015; Smyth et al., 2009), but more research on this topic seems warranted (Matjašič et al., 2018; Meade and Craig, 2012; Revilla and Ochoa, 2014).

Effects of different survey modes

Early research in this area found indications that the survey mode adopted (electronic survey versus paper or interviewer-assisted surveys) can affect the quality of obtained data, even when the same questions are used in the same population (Kiesler and Sproull, 1986). Several comparative studies between web-based questionnaires and other survey methods have been performed since then. While some studies have found that data quality is not altered in web versus face-to-face surveys (Bishop et al., 2010; Davidov and Depner, 2011; Knapp and Kirk, 2003; Mangunkusumo et al., 2005; Raat et al., 2007; Ritter et al., 2004; Shapka et al., 2016; Weigold et al., 2013), there are others that show face-to-face or paper questionnaires yield different results to web surveys (Buchanan et al., 2005; Heerwegh and Loosveldt, 2008). If multiple modes are used, piloting surveys with a small number of participants is recommended to identify any systematic differences between the different approaches (Buchanan et al., 2005).

Earlier studies that assessed the effect of technology on participating in otherwise identical surveys found that web surveys have lower response rates than mail or interviewer-assisted surveys (Leece et al., 2004; Spijkerman et al., 2009), but more recent research has shown the opposite (Russell et al., 2010). Currently, the population of young adults and youth, who are often the main target group in drug surveys, seem to prefer online data collection methods to paper-based questionnaires or telephone surveys (Hunter et al., 2013; Russell et al., 2010; Shapka et al., 2016). Mobile web surveys (mostly using smartphones, but also tablets) have become yet another popular platform for administering web surveys (Couper et al., 2017; Lugtig and Toepoel, 2015).

However, while mobile devices could contribute to allowing greater access to respondents, some concerns remain. First, responding to surveys via a smartphone could compromise confidentiality and the privacy of the subject if done in public places with bystanders present. In this respect, studies found no significant differences in responses to sensitive questions (Mavletova, 2013; Toninelli and Revilla, 2016), except for questions pertaining to alcohol consumption (Mavletova and Couper, 2013). At the same time, Mavletova and Couper (2013) also found that answers to sensitive questions were influenced by the presence of familiar bystanders, but not by strangers. Second, the (small) size of the device might affect the quality of responses. In particular, results may be biased if not all answer options are visible on the screen at once; hence, optimising the questionnaire for mobile devices is an important step (Stapleton, 2013).

According to some studies, completing surveys on smartphones takes more time (Buskirk and Andrus, 2014; De

Bruijne and Wijnant, 2013; Keusch and Yan, 2017; Wells et al., 2013), generating greater non-response rates (De Bruijne and Wijnant, 2013; Struminskaya et al., 2015), higher drop-out rates (Wells et al., 2013) and more missing answers (Keusch and Yan, 2017; Struminskaya et al., 2015), in addition to yielding shorter entries in open-ended questions (Mavletova, 2013; Peytchev and Hill, 2010). Other studies, however, show that the mobile device in itself has a minimal effect on survey responses (Tourangeau et al., 2017; Wells et al., 2013). Instead, it is suggested that any differences are related to the self-selection of the particular device to be used for the survey (Keusch and Yan, 2017; Lugtig and Toepoel, 2015), or to the fact that mobile users are more prone to distraction and thus take longer to complete the survey (Andreadis, 2015).

Non-probabilistic sampling: limitations and opportunities

While the technical advantages of web survey methods are important, their applicability may be limited by the difficulties involved in sampling and, relatedly, drawing inferences about broader populations. In the absence of suitable sampling frames, most of the major drug-related web surveys, and all of those discussed in this report, have used purposive, non-probabilistic (convenience) sampling and can be described as 'unrestricted, self-selected surveys' (Couper, 2000). As such, while particularly large samples can be reached with web surveys, such surveys are usually not representative of the general population or of any pre-defined populations of people who use drugs (Barratt et al., 2015).

The use of web surveys to target specialised groups

The current socio-economic discrepancies in terms of who has access to the internet would appear to provide an argument against using online tools to reach marginalised groups of people who use drugs. On the other hand, web surveys tend to have higher response rates in 'expert' populations (i.e. people with a greater interest in the topic) on any subject (Duffy et al., 2005; Szolnoki and Hoffmann, 2013). This suggests that web surveys might be suitable to gain detailed information from certain groups of people who use drugs and are experienced users. Overall, non-probabilistic samples of respondents (who are recruited through convenience sampling and who self-select to answer the survey) tend to be more motivated and knowledgeable about the survey's topic (Chang and Krosnick, 2009). This fact indicates that rather than researching prevalence rates, non-probability sampling could be suitable for obtaining

in-depth knowledge on the researched issue, for example in relation to aetiology, prognosis or comorbidity (Heiervang and Goodman, 2011). In particular, drug users who research drug use online, or follow or contribute to online discussion boards, or obtain their drugs online might be the best target populations for web surveys, providing in-depth insights in these areas and evidence for emerging trends.

Web surveys are often able to generate large samples of respondents quickly, but this still depends on the researcher being successful in reaching the target population and persuading them to participate. Different approaches may be used to achieve this and to increase response rates. Techniques include providing information on survey duration and using email to distribute survey invitations and reminders to those who have not started or have still to finish the survey (Crawford et al., 2001). The use of text messages has been shown to be effective in prompting participation in web surveys that use smartphones (Mavletova and Couper, 2014, 2016). Where no sampling frame of email addresses or mobile phone numbers is available, various methods of survey advertising, such as paid posts on social networks and promotion on related online discussion boards or on relevant websites, can be used to increase the number of responses. Financial incentives for filling out a web survey can also be offered (e.g. through a lottery of participants who opt to provide their contact details), but this should be accompanied by technical solutions that prevent multiple responses by the same respondent, which is usually done by permitting only one response per device or IP address (Bowen et al., 2008; Teitcher et al., 2015).

Thus, when taking into account the potential for accessing large samples, together with the ability to minimise interviewer-driven discomfort or even stigma (Epstein et al., 2001), online methods seem to be a suitable tool to survey drug-use behaviours and to engage populations of people who use drugs who could otherwise be hard to reach and would remain hidden to traditional survey methods (Barratt and Lenton, 2015; Brick, 2015; Wagner and Lee, 2015). In that respect, web surveys have great potential for reaching significant numbers of experienced drug users, obtaining information quickly about emerging trends in substance use, gaining in-depth knowledge about respondents' drug-use histories and drug market experiences, and, overall, exploring the relationships between variables (Barratt et al., 2017).

Sampling and coverage biases in web surveys

People who respond to web surveys can differ significantly from those recruited via probabilistic sampling methods. Biases in non-probabilistic web surveys can result from sampling error, coverage bias and non-response issues

(Couper, 2000). For example, it will not be known what proportion of the target population (e.g. new psychoactive substance users) has been reached by a web survey recruitment advertisement, whether all groups of the population of interest have access to the internet or to the particular platforms where the surveys have been advertised, or who has been reached by the web survey but decided not to respond. Since neither the characteristics of the non-responding groups or individuals, nor how they differ from those who responded to the survey can be known, it is difficult to ascertain the extent and nature of these biases.

In general, differences in internet use exist across countries (Richiardi et al., 2014) as well as within them — use is more likely among people with higher education and socio-economic status and in younger age groups (Blasius and Brandt, 2010; Szolnoki and Hoffmann, 2013). However, with access to the internet expanding, in the future, web-based surveys will have the potential to reach a much larger population, with increasingly similar attributes to the general population (Russell et al., 2010). In particular, the growing use of smartphones has the potential to increase the accessibility of web surveys (Couper et al., 2017; Wells et al., 2014).

In the interest of understanding the degree to which web surveys contain bias, several studies have compared the characteristics of those who report using drugs in online (non-purposeful) and representative population surveys. Several conclusions can be reached from this research. Relative to surveys using probabilistic sampling methods, web surveys tend to recruit participants with higher drug-use prevalence rates, as well as greater numbers of males, younger people, those with higher education and people living in urban areas (Barratt et al., 2015; Barratt et al., 2017). However, once probability samples are restricted to those who use a particular substance and grouped by demographic categories such as gender and age, substance use outcomes appear rather similar (Barrett et al., 2017; Miller and Sønderlund, 2010). The implication is that web surveys are excellent tools for comparing characteristics among people who use drugs, but not for simple measures of prevalence. However, several emerging statistical techniques, such as bootstrapping (Barratt et al., 2015), regression and raking (Caulkins et al., 2022), and propensity score matching (Spilka et al., 2022), are promising avenues for using web surveys alongside data from general population surveys in such a way as to allow for greater generalisability. Furthermore, the use of general population surveys has lately been challenged by high non-response rates, which may make their samples less representative than in the past (Brick and Williams, 2013).

Towards representative web surveys

When choosing an appropriate survey method, researchers will need to weigh the costs and benefits of each approach, bearing in mind the utility of convenience samples if the research aims to explore new ideas and trending issues (Leiner, 2014). However, if representativeness is a priority, methods that aim to decrease sampling biases must be prioritised.

For instance, web survey tools can be used to survey respondents who were sampled via probabilistic methods or recruited by other means than advertising a survey online (Schaurer, 2017). This approach may include providing online devices to people who have been recruited for a representative survey and would not otherwise have access to an appropriate device. However, establishing a representative sample with access to online devices might be costly. Also, the sensitive nature of substance use has historically favoured one-off, cross-sectional population samples, rather than following the same individuals over time. Hence, the challenges posed by the logistics of providing online devices for one-off use might outweigh the efficiency benefits of online data collection. Researchers could, however, approach specialised agencies that collect data within their pre-established representative panels to arrange for the addition of a drug survey module that might be included at a reasonable cost and yield results within a short timeframe. Online tools can also be part of a mixed approach, with respondents being offered a choice of completing the survey online or using more traditional survey modes (Atkeson and Adams, 2018).

Other approaches that include probability sampling are intercept surveys or list-based samples (Couper, 2000). According to Couper (2000), intercept surveys are similar to 'exit polls' at elections in that they can randomly target visitors of particular webpages upon entry or exit. While currently rare in the drug-use context, this approach could target people who visit drug-help portals or other specialised webpages, such as online discussion boards. The population that this method can draw inferences about remains the visitors of the particular webpage (rather than any broader group), and responders can be compared to non-responders in terms of, for example, which parts of the webpage they accessed. List-based samples, on the other hand, involve approaching random or all members of a group — for example, patients, students or employees. Confidentiality issues might be a concern here, as well as a lack of motivation to participate in the survey, and hence low response rates or data-quality issues could be a problem (Couper, 2000).

A compromise solution between probabilistic and convenience sampling can be found in samples from online volunteer panels of internet users that are stratified based on pre-

defined characteristics such as gender, age or geolocation (Brick, 2015; Couper, 2000). While such an approach mitigates the issues related to non-response bias, given that the characteristics of both respondents and non-respondents are known, coverage bias remains present in this method because respondents who are not online are not included. The coverage bias seems to persist even when sophisticated weighting methods are applied and outcomes are compared to representative population surveys (Blasius and Brandt, 2010; Duffy et al., 2005; Lee, 2006; Loosveldt and Sonck, 2008).

Conclusions: the present and future of web drug surveys

Web surveys offer numerous technological advantages in researching sensitive social issues including drug use. The technological features of web surveys can help optimise data collection and improve data quality, making this approach a cost-effective solution for cross-national studies. Web surveys are also more popular among young people, which can be useful in terms of gathering detailed information on patterns of drug use but is also a potential bias to be recognised. As use of the internet and mobile devices spreads, web surveys have the potential to reach more representative samples in the future. However, the use of online technology still has some unresolved questions, such as the best ways to identify satisficing bias, prevent drop-outs and minimise 'don't know' answers.

The main issue with web-based surveys on drug use so far has been that they have involved convenience, self-selected samples. This limits the possibility of drawing inferences to representative populations, although studies have demonstrated that the differences between people who use drugs in web surveys and general population surveys were small once samples are restricted to those using a particular substance and when grouped by demographic categories such as gender and age. Further developments in the use of online methods could involve online data collection from representative population samples, the use of intercept and name-based samples or the stratification of online panels; but none of these approaches is without its limitations.

For the moment, self-selected online drug surveys remain an important tool for collecting data from expert, hard-to-reach and/or hidden populations of people who use drugs. They can provide in-depth insights into patterns, practices and features of drug use and drug markets, and the relationships between these variables. Also, given the efficiency of web surveys, information about emerging trends can be rapidly retrieved

via these methods. Triangulation with other online as well as traditional epidemiological data sources could help increase the validity and meaningful interpretation of this data.

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The European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) is the central source and confirmed authority on drug-related issues in Europe. For over 25 years, it has been collecting, analysing and disseminating scientifically sound information on drugs and drug addiction and their consequences, providing its audiences with an evidence-based picture of the drug phenomenon at European level. Based in Lisbon, the EMCDDA is one of the decentralised agencies of the European Union.

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EMCDDA project group: João Matias, Alexander Soderholm, Katerina Skarupova, André Noor and Jane Mounteney.

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EMCDDA, Praça Europa 1, Cais do Sodré, 1249-289 Lisbon, Portugal
Tel. (351) 211 21 02 00 | info@emcdda.europa.eu
emcdda.europa.eu | twitter.com/emcdda | facebook.com/emcdda