

Article submitted to Advances in Psychiatric Treatment:

The use of internet-mediated cross-sectional studies in mental health research

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Abstract: This article summarises internet-mediated approaches to conducting quantitative and qualitative cross-sectional mental health research, and describes important aspects of research design to consider for optimising scientific rigor and validity as well as response. Rapid adoption of internet-mediated approaches risks compromising the quality of the methods used. Not only can this cause participant distress, but methodological issues may lead to inappropriate inferences being made from research findings. In this article the advantages of using internet communication for research purposes are balanced against the disadvantages, using examples of recent internet-mediated research studies to illustrate good practice.

Learning objectives

1. To appreciate the range of epidemiological study designs for which internet-mediated research methods might be applied
2. To understand the advantages and disadvantages of using internet-mediated approaches to cross-sectional studies in mental health research.
3. To gain confidence in designing internet-mediated cross-sectional studies so as to minimise relevant biases and any potential distress to participants.

Introduction

The introduction of internet communication by Sir Tim Berners-Lees in 1989, and its widespread adoption since then, has opened up new methods for the sampling of research

participants and the collection of qualitative and quantitative data from respondents. This development has significant implications for the expense and workload of conducting epidemiological research, particularly when compared with the methods previously relied upon. Internet sites and email communication have created opportunities for researchers, even those on limited budgets, to conduct large-scale studies whilst reducing postal and paper costs, data transcription, and the biases resulting from researcher presence. These advantages have resulted in the rapid adoption of internet-mediated research techniques. However, there is a risk that their unthinking application could compromise the quality of the study by introducing biases in sampling or in data collection inherent to the internet modality. There is also the concern that whilst the relative anonymity of internet methods might enhance disclosure and minimise social desirability, this anonymity also creates its own problems, including that of inability to monitor respondent distress.

This article focuses on cross-sectional studies, because that is the approach used most frequently by clinical trainees, and is intended to inform such practice. By outlining the applications of IMR in a mental health context this article sets out a framework by which researchers might attempt to overcome the disadvantages of IMR when conducting their own cross-sectional studies or appraising others'. Whilst acknowledging the role of bias and the limits to generalisability, there are many benefits to be gained from an internet-mediated approach to psychiatric epidemiological research, not least an enriched understanding of human behaviour, mental distress and psychiatric morbidity.

Definition of internet-mediated research

Most broadly, internet-mediated research (IMR) describes the practice of gathering research data via the internet directly from research subjects. Generally participants can respond to a questionnaire or task at a time and place of their choice, provided that they have access to the internet. It can apply both to the sampling of research participants, and to the collection of data.

Traditionally, sampling methods for community-based epidemiological research have included use of the telephone via random digit dialling, postal surveys or personal visits to randomly-selected private households, or by directly approaching people on the street. Sampling methods for research in patient populations have tended to use the approach of telephone, letter or direct contact with those selected from patient databases. Traditional

methods of data collection in both community-based and patient surveys have included interviews, either face-to-face or via telephone, and the completion of postal survey questionnaires. Newer approaches include text messages, for example as consumer satisfaction surveys linked to service use.

The advent of the internet means that sampling can now be carried out using email distribution lists, snowballing via social networking sites, or website advertisements. The internet also permits a variety of methods of data collection. Online surveys derive from the early role of computers embedded into face-to-face interviews, where interviewers switched to computer-assisted self-interviewing (CASI) mid-interview for sensitive aspects of the data collection (de Leeuw ED 2005). Following a set of verbal questions on a relatively neutral topic, such as level of social support, the interviewee would then be passed a computer and asked to enter responses to questions on a topic such as sexual history. Typically the interviewer would leave the room, albeit remaining accessible for queries, returning later to resume the interview. This diminishment of researcher presence is now extended through the use of online questionnaires, which collect quantitative and qualitative data using website survey software, the most well-known being Survey Monkey. Email responses can also be used when briefer responses are required, as with internet sites such as The BMJ's weekly poll. Interviews are possible using video conferencing software such as Skype or Facetime. Focus group discussions can be facilitated using an online chat forum.

Internet-mediated health research has been used most frequently for conducting cross-sectional studies, but can also be applied to other observational studies, such as case-control studies, cohort studies, and even ecological studies. One example of such an ecological study relies on the dominance of specific search engines; using Google Trends to explore the relationship between frequency of search terms relating to suicide method and national suicide rates (McCarthy 2010). Valuable perspectives have also been gained by harvesting research information from existing internet sites. Linguistic analysis of text harvested from Facebook content has been analysed to develop a depression screening tool (Park S et al. 2014). Simulating a web search is a useful means of exploring patients' exposure to information on health matters or on suicide methods (Biddle et al. 2008), but search result customisation must be disabled for such simulations to avoid past search activity influencing the results.

Further applications of IMR lie in studies of human cognition and behaviour using psychological tasks embedded in online programmes, such as perceptual or cognitive tasks. Methods of assessment include scores on neuropsychological tests, or measurement of response times. Similarly the collection of outcomes for interventional studies is possible, measuring temporal changes in standardised instruments such as the Beck Depression Inventory or the Addenbrooke's Cognitive Examination, or measurements of performance on tasks such as time taken to perform a trail test. Finally, IMR can be applied to the evaluation of IMR research methodology, for example by comparing the time taken to complete each component of a task under differing conditions, or by varying participants' knowledge of a researcher's gender or ethnicity to investigate the impact on responses.

Specific sampling considerations in IMR cross-sectional surveys

When designing the sampling strategy for an internet-mediated cross-sectional study, the distinction between closed and open surveys is critical. An open survey usually involves a web advert, or one advertised via social networking sites. In this case the researcher has no control over who might respond, creating problems in estimating the sampling frame or its representativeness. One example of an open survey was a US study measuring the benefits and risks of online interaction among adolescent girls (Berson et al. 2002). This used an online survey advertised on the website of *Seventeen Magazine* in 1999, inviting the participation of 12-18 year old girls. It found that 45% had revealed personal individual to a stranger met online, and 23% had disseminated pictures of themselves to another person encountered online. Exposure to having discussed internet safety with a teacher was associated with a reduced risk of agreeing to meet with someone they had met online. One of the key limitations of this open survey design was that the denominator of those accessing the site could not be characterised reliably, and it was not possible to verify whether those responding really were aged 12-18. The results arising from this convenience sample could not therefore be said to be representative of all US adolescents, and may not be generalizable beyond the website's users.

In contrast, a closed internet survey is by invitation only, usually via email. In this situation the denominator is known, allowing measurement of response rate and non-response bias. It may also be possible to gather information about participant demographics in order to assess the nature of the sample obtained and the generalisability of results (Hewson C 2003). Closed surveys are therefore preferred, although technical barriers (such as requiring respondents to

designate a characterising feature, such as their institution) must be introduced to confine responses to invitees only. For example an invitation to participate in an online survey sent via the email distribution list of a specific trade union might easily be forwarded by any of the invitees to a friend within another union. On opening the survey link within that email, a request for respondents to state their trade union would allow researchers to exclude those for whom the survey was not intended. This could be done using branching restrictions incorporated into the questionnaire, making it impossible for anyone to proceed if they were not from the intended organisation. It would obviously be possible to overcome such a restriction by those determined to participate, as discussed below in relation to validity issues in IMR. For reasons of research ethics it would also be good practice to state clearly the inclusion and exclusion criteria for the study. Otherwise, where branching restrictions were not possible, ineligible respondents who contributed their time to completing the questionnaire in good faith would find their efforts disregarded.

The email sampling format is a common approach when using a closed survey design. A 2009 survey of trainee psychiatrists used the email distribution lists of 4 out of 8 London-based training schemes, to establish the proportion and characteristics of those who undertook personal psychotherapy (Dover et al. 2009). A web-based survey gathered quantitative and qualitative data, achieving responses from 140/294 (48%) trainees. This found a prevalence of 16% for uptake of personal psychotherapy, but the authors acknowledged that self-selection bias might have led to this being an overestimate.

University email distribution lists have also been used in mental health research as a sampling frame for community-based studies. Factors favouring a reasonable response from eligible individuals using the university email sampling method are that recipients are a defined and captive population, accustomed to participating in email or internet surveys, sympathetic towards research activity, proactive and internet-literate, and able to participate at minimal direct financial cost. Although the use of university circulation lists potentially reaches a large number of young adults, it also introduces the potential for selection bias, particularly in relation to socio-economic status and the healthy worker effect (Delgado-Rodriguez and Llorca 2004). Factors mitigating these biases include the expanding proportion of young people entering higher education, with 46% of the general population of an eligible age entering higher education from the mid-1990s to 2010 (HEFCE (Higher Education Funding Council for England) 2010), and the increasing social and cultural diversity of this group

(Royal College of Psychiatrists 2011). The healthy worker effect is also balanced by concerns about the mental health of students (Royal College of Psychiatrists 2011) (Stanley N et al. 2007; Stanley N and Manthorpe J 2002). At worst, generalisability from studies using university email distribution lists is limited to those studying in other universities in the same country. However, with increases in UK student fees reducing the numbers of people who can afford tertiary education, future studies using the email sampling method within universities may become less generalisable to the general population.

A 2005 study of the community prevalence of paranoid thoughts sampled 60,200 students at UCL, King's College London, and the University of East Anglia (Freeman et al. 2005). Each student was sent an email inviting them to participate in an anonymous internet survey on 'everyday worries about others'. The survey, which included 6 research scales, was completed by 1,202 students, representing a response of 2%. The authors reported that paranoid thoughts occurred regularly in approximately a third of the group. Criticisms of this method related to non-response bias and the representativeness of the sample. For a survey on paranoia, it was possible that the most paranoid members of the population sampled would find the topic very salient, or conversely be highly suspicious of it. This might increase, or decrease, their likelihood of responding; resulting in an over- or under-estimate of the prevalence of paranoid thoughts. Students from the three universities participating represented a predominantly London-based Russell Group university sample, and might not be considered an epidemiologically-representative sample. Inclusion of more diverse educational institutions, both geographically and socio-economically, was indicated for future studies to improve representativeness in relation to studies of prevalence. For studies comparing groups recruited via email sampling of universities, deriving controls from the same sample would mean that any such biases would be equally distributed, and this could also be addressed statistically by adjusting for socio-economic status.

Research on the factors enhancing response to research surveys mainly relates to postal questionnaires, but many of these factors apply to IMR surveys too. A systematic review of studies investigating response rates to postal questionnaires evaluated 75 strategies in 292 randomised trials, with its main outcome being the proportion of completed or partially-completed questionnaires returned (Edwards P et al. 2002). Factors favouring the probability of responding included: monetary incentives, short questionnaires, personalised questionnaires and letters, making follow-up contact, greater salience of research topic,

questions not of a sensitive nature, and the questionnaire originating from universities (Edwards P, Roberts I, Clarke M, DiGiuseppi C, Pratap S, Wentz R, & Kwan I 2002). Qualitative work with student samples confirms that willingness to complete web-based or paper-based questionnaires is influenced by the relevance of the topic to their life experience (Sax LJ et al. 2003). A study investigating incentive structures in internet surveys used a factorial design to send a web-based, self-administered survey to 2,152 owners of personal websites (Marcus B et al. 2007). Combinations of high *versus* low topic salience, short *versus* long survey, lottery incentive *versus* no incentive, and general feedback (study results) *versus* personal feedback (individual profile of results) showed higher response rates for highly salient and shorter surveys. There was evidence for an interaction between factors: offering personalized feedback compensated for the negative effects of low topic salience, and a lottery incentive tended to evoke more responses only if the survey was short (although this was of marginal significance).

Specific data collection considerations in IMR cross-sectional surveys

The Data Protection Act 1998 applies to any survey that requires respondents to enter personal data that can identify them, or any survey program that uses tracking facilities to enable identification of an individual. In this case your information sheets should include a Data Protection disclaimer explaining that the personal information they provide will only be used for the purposes of the survey and will not be transferred to another organisation. It would also be important to check with your institution whether registration with the Data Protection Officer or equivalent is required before starting to collect data. Mentioning such aspects in the ethical approval application form will demonstrate that the study has been carefully planned.

When choosing an online survey program, consideration should be given not only to cost but to appearance, the ease of constructing each format of question (for example, Likert scale, numeric response, multiple-choice, drop-down response, free text), the process for downloading data, and data analysis capabilities. Most programs allow data to be downloaded into Microsoft Excel, but some permit data to be downloaded directly into statistical packages such as SPSS. This is preferred for maintaining the integrity of data. Costing for online survey programs tends to operate on an annual subscription basis. It may be more economical to conduct two or more surveys at the same time, making sure that there is sufficient time

within the subscription period to become proficient in the techniques of questionnaire construction, to recruit participants, and complete data collection.

When designing the survey questionnaire, it is helpful to use the general principles governing quantitative and qualitative questionnaire design (Bowling A 2002;Boynton 2004;Boynton et al. 2004;Boynton and Greenhalgh 2004;Jackson CJ and Furnham A 2000;Malterud 2001;Oppenheim A.M 1992), as well as those specific to IMR (Burns KEA et al. 2008;Eysenbach 2004;Hewson C 2003). These suggest a range of ways in which the cost and convenience advantages of IMR can be harnessed whilst minimising potential biases and validity issues. Guidelines suggest that that IMR surveys state clearly the affiliation for the study, to give it credibility, enhance participation and avoid hostile responses. Surveys should provide clear electronic instructions to guide respondents, with links to further information if required. As well as providing information on confidentiality, the procedure should be described in the event that participation causes distress. Many surveys provide a debrief page containing a list of sources of support. This is often visible as the final page of the survey, but also accessible throughout the questionnaire via a button at the foot of each page.

Internet-based surveys can present questions in a single scrolling page (for short polls) or a series of linked pages (multiple-item screens), and layout is an important influence on response rates and completion rates. Conditional branching, also known as skip logic, can reduce the apparent size of a survey, and use of a progress indicator at the bottom of the page (for example, “15% complete”) may motivate completion. Conditional branching may also reduce the chances of distressing or annoying participants through asking them irrelevant questions. An internet survey on attitudes toward affirmative action sampled 1,602 students, using three different design approaches (Couper 2001). One version reminded respondents of their progress through the survey; one version presented several related items on one screen, while the other version presented one question per screen; and for one series of questions a random half of the sample clicked option buttons to indicate their answers, while the other half entered a numeric response in a box. Responses showed that multiple-item screens significantly decreased completion time and the number of “uncertain” or “not applicable” responses; respondents were more likely to enter invalid responses in long- versus short-entry boxes; and the use of fixed option buttons may decrease the likelihood of missing data compared with free text entry boxes (Couper 2001).

Missing data is a critical issue in any epidemiological study, and the proportion of missing data can be minimised by aspects of IMR survey design. Cramming a webpage with questions increases the chances that a respondent will move on to the next page without realising that they have missed a question, in which case the missing data point would be regarded as missing completely at random. Keeping the questionnaire brief and focussed will decrease the chances that those under great pressure of time will dropout midway. As this may be associated with socio-economic factors, such missing data might be regarded as missing not at random. Carefully wording the questions, and ordering them so that sensitive questions appear at a later stage, reduces the chances that respondents will drop-out due to psychological distress.

Ideally, depending on the research topic, an online survey will use multiple-item screens (to decrease completion time, reduce “not applicable” responses, and allow data-saving with each page change), short-entry boxes (to reduce invalid responses), and fixed option buttons (to reduce the need for coding or checking outliers) where possible. Free text boxes can be included where extra information might be required, recognising their limitations (Garcia et al. 2004). Most notable among these is the potential for collecting large volumes of qualitative data for which there may not be the capacity to analyse. Where free text information qualifies a key quantitative variable such as socio-economic status, it may take some days to recode the text, depending on the number of responses. Classification of socio-economic status is a good example of this. The National Statistics Socio-economic Classification (NS-SEC) based on the Office for National Statistics Standard Occupational Classification 2010 (SOC2010), is a common classification of occupational information used in the UK, with jobs classified in terms of their skill level and skill content (ONS (Office for National Statistics) 2010). To determine which social class a survey participant should be classified as, they may be asked to give their job title or current employment status, and briefly describe work responsibilities. This information, sometimes quite detailed or difficult-to-understand, will need to be recoded manually into one of 9 socioeconomic classes. Conversely, using fixed-choices to ask respondents which social class they belong to raises validity issues.

Seeking advice on content, tone, language, ordering of questions and the visual appearance of the survey will benefit response. It is useful to canvas opinion among people of a similar age or background to the sample population, not only for their views on successive drafts of the

survey content, but also on its colour scheme and layout when uploaded to the survey program. This also applies to the sampling email, where off-putting use of jargon may disincline eligible recipients to respond. Describing the consultation process in the ethics approval application form will also demonstrate that the survey is likely to be acceptable to the sample population.

Validation checks are advisable for providing evidence that internet-mediated research measures capture what they purport to. For example, comparing the results of an IMR study with established results of face-to-face psychometric interviewing may show systematic differences on some psychological variable. By introducing constraints on the flexibility of participants' behaviour it might be possible to control parameters that must remain constant, for example time taken to complete a task. In some contexts it may be possible to gather information about participants, such as browser type, IP address, and date and time of response, in order to detect multiple submissions. However use of shared computers and virtual private networks (VPN) would obscure this, and access to information on IP address may be unethical.

Finally it is important to pilot the study extensively in a range of samples and formats to detect any operational issues before administration of the actual study procedure. It is very difficult to predict where a glitch could arise, and if respondents encounter a problem when completing the online programme it could render the data completely useless as well as wasting their time.

Advantages of IMR

Cost

IMR has the potential to gather large volumes of data relatively cheaply and with minimal labour, involving automatic data input to a database of choice. Compared with postal questionnaires IMR cuts out postal and printing costs, as well as the labour costs of data entry, although the latter is essentially transferred to individual respondents. The paper-free approach may also be more environmentally-responsible, although computer manufacture and internet usage both contribute to carbon emissions.

Time

IMR reduces the time taken to process individual paperwork by eliminating the printing and postage of questionnaires, as well as the tasks of transcription and data entry. This can reduce the length of the data-gathering phase, which suits those on a limited time-frame. Coding of data, such as that involved in statistical packages such as SPSS or STATA, can commence as soon as the first subject has responded. Downloading an interim dataset, even that with only one respondent, gives a sense of how the data will appear. With successive downloads of interim datasets, it may be possible to start data cleaning at an early stage. This involves the detection and removal of inconsistencies in the data, to improve its quality. Detecting and managing outliers is one example of the data points processed during data cleaning. To give an example of this, postal questionnaires returned from a sample of working age adults might include one copy in which the respondent gave their age as 5. This is most likely to have been an error. The outlier would be spotted and some decision would have to be reached over whether to guess the age from other parameters in the questionnaire, whether to contact them to verify their age, or whether to enter this as missing data. In an online survey, fixed-choice responses for age would eliminate the possibility of outliers for age, reducing the time taken for data cleaning.

Convenience

For research subjects data collection via the internet presents fewer barriers to participation than keeping appointments, or posting back a questionnaire (Whitehead LC 2007). This also has the potential to reduce the timescale of the study. By widening participation in this way, IMR may be able to address sampling biases by reaching traditionally difficult-to-access groups such as rural populations, people living with illness, frailty and disability, and shift workers. This is supported by evidence that age, nationality and occupation have typically been found to be more diverse in internet samples (Hewson C 2003), and that IMR has been used to engage with hard-to-reach groups including ‘senior surfers’, disadvantaged teenagers, and people living with disabilities, dementia, and depression (Whitehead LC 2007). This widening of geographical access increases the opportunities for cross-cultural research.

Impact on reporting bias

IMR, as with postal surveys, has the potential to reduce the biases resulting from researcher presence by diminishing social desirability effects (Joinson AN 1999), enhancing disclosure

(Joinson AN 2001), and reducing the influence of interviewee perceptions of a researcher's ethnicity, gender or status on interactions (Richards H and Emslie C 2000). The anonymity of the internet enhances disclosure when compared with interview methods (Joinson AN 2001), although in relation to mental health research it remains possible that denial or the stigma associated with mental disorder (Clement et al. 2014) may result in under-reporting of psychiatric symptoms. It is thus particularly suitable for sensitive topics, such as sexual behaviour or psychiatric symptomatology, and socially undesirable behaviours, such as alcohol abuse, where underreporting bias is common (Delgado-Rodriguez & Llorca 2004). One qualitative study of health behaviour changes in patients affected by colon cancer compared findings from face-to-face versus online chat focus groups, finding that similar themes emerged from both groups but that the anonymity of the internet provided a more comfortable forum for discussing such personal issues (Kramish CM et al. 2001). Despite anonymity minimising such biases, this must be balanced against the particular biases that IMR introduces. These are discussed below, and are a key drawback of its use.

Disadvantages of IMR

Technical

IMR relies on access to a computer and the computer literacy of respondents. There is a risk of non-response through email invitations being recognised as Spam, or deleted as Junk. Where an email invitation to participate in research appears as part of a weekly email digest, such as that sent out in many large institutions, there is a risk that this will go unnoticed by those eligible. One study of student samples found that responses were lower for web-completed than paper-completed questionnaires, with the suggestion that many students had not checked their email (Sax LJ, Gilmartin SK, & Bryant AN 2003). People who rely on shared computers are denied the privacy required for surveys on sensitive topics. Where internet connectivity is poor there is a risk of the programme crashing and losing data, or respondents giving up due to long pauses between screens. As poor internet connectivity may be governed by socio-economic factors this may increase the amount of missing data from those on lower incomes; thus introducing bias. Keeping the questionnaire brief and limiting the use of videos may reduce the chances of the programme crashing. Another technical disadvantage is that without the reminder afforded by a hard copy of the questionnaire there is a risk that respondents who save halfway through, with the intention of returning, may forget to resume. This can partly be overcome with the use of email reminders if using a

closed survey, in line with research indicating that responses to postal research questionnaires are higher if follow-up contact is made (Edwards P, Roberts I, Clarke M, DiGuseppi C, Pratap S, Wentz R, & Kwan I 2002).

Specific biases

Both sampling bias and non-response bias are key issues in internet-mediated surveys. Sampling biases arise from the sites selected to advertise surveys, the email distribution lists used to circulate an invitation to participate, or the manner in which an announcement on a social networking site is propagated. For example, in a study measuring cognitive styles among those with eating disorders, a recruitment advertisement on the website of an eating disorders support website would bias findings, such that the cognitive styles of those with insight were represented. Similarly, a study of the community prevalence of depression using a government employee email distribution list would underestimate the actual prevalence by excluding the unemployed, described as the healthy worker effect (Delgado-Rodriguez & Llorca 2004).

Such biases can be addressed by using closed surveys for specific invitees only, whilst ensuring that those invited are a suitably representative sample. Where a closed survey is not possible, thought must be given to whether the salience or sensitivity of the topic is likely to impact on the extent or manner in which it is advertised. Whilst it may not be possible to control this, this may influence the covariates chosen for adjustment of quantitative findings. For example a study comparing the attitudes of those in different age groups towards those with body dysmorphic disorder might garner more intense interest on sites popular with certain ethnic groups, suggesting that the analysis should adjust for ethnicity.

Non-response bias is another problem affecting all modalities of cross-sectional surveys. In the civil servant example above differential non-response could apply to those on sick leave not checking their email, or those with depression lacking the motivation to read and respond to emails. Given the traditional tendency for a female gender bias in psychosocial health surveys (Hewson C 2003), IMR offers the potential to redress this. The internet-user population has been characterised as technologically-proficient, educated, white, middle-class, professional, and male. This, and the relative anonymity of internet surveys, may serve to minimise male non-response bias. Overall there is mixed evidence for whether internet samples are more gender-balanced than traditional methods, whether IMR introduces a male

gender bias (Hewson C 2003), or indeed whether the female gender bias applies to IMR too (Freeman, Garety, Bebbington, Smith, Rollinson, Fowler, Kuipers, Ray, & Dunn 2005). Additionally, as patterns of population internet coverage change, any balancing of the traditional female response bias to surveys is likely to shift again.

Validity

There are issues with the validity of IMR, particularly through the lack of a relationship with participants. Without monitoring body language, tone of voice, or signs of distress there is less control over or knowledge of participant behaviour, which also raises questions about how distress might be responded to. In the absence of monitoring or programming restrictions, subjects may violate instructions, for example by backtracking to cheat in a memory task, or gaming responses to force their way down specific branches of the survey. There is the potential for contamination through third party involvement (for example, respondents consulting a friend), use of reference materials, or hoax respondents, and the potential for distraction or intoxication by alcohol or drugs but all these issues apply also to postal questionnaires. Validity of internet-mediated responses may be checked using comparison methods and programming checks. For the above reasons, IMR may be invalid for conducting diagnostic interviews requiring considerable subjective judgement on the part of the assessor. On the other hand, there is evidence that differences in the reliability of interview methods for diagnosing psychiatric disorder compared with self-administered questionnaires are only modest (Lewis G et al. 1992).

Ethics

The ethical problems in using IMR start with obtaining fully informed consent. In some studies the participants may not even be aware that they are participating in a research study, but this must be agreed by a research ethics committee. One example of such an approach is provided by a randomised controlled trial of a brief online intervention to reduce hazardous alcohol use among Swedish university students (McCambridge et al. 2013). The study utilised the standard practice of student health services sending out emails to university students by including within such emails an apparent 'lifestyle survey' at baseline and three months follow-up. The study found that those randomised to alcohol assessment and feedback on alcohol use showed a significant reduction in the proportion of risky drinkers compared with a group who did not receive alcohol assessment and feedback. The regional

ethics committee approved the use of masking and deception in this study on the grounds that concealing the alcohol study focus would permit adequate blinding of participants.

In studies involving informed consent links to information sheets and consent forms should be provided, but it is difficult to check whether these have been read before a respondent ticks a checkbox linked to a statement of agreement to participate. The difficulties of establishing capacity to consent are obvious, and this may have an impact on data quality. It is important that participants are reminded that they may withdraw from the study at any time, and to provide a 'Submit Data' button to ensure they understand and agree that their responses are being submitted to the researcher. With data stored on web-servers where they may be vulnerable to hacking there are concerns about confidentiality and security of data, particularly where monetary incentive structures might require identifying information such as an email address to be submitted (Sax LJ, Gilmartin SK, & Bryant AN 2003). It is important to assure participants of confidentiality of their responses, and to describe the data storage security measures set up to minimise the possibility of any other parties gaining access to the study data (Hewson C 2003).

Requiring subjects to respond to research questions at home, rather than in the formal setting of a research department, may result in a blurring of the public-private domain distinction. However this also applies to many surveys in which data is gathered by interview or postal questionnaire, and is balanced against the convenience and cost advantages to respondents and researchers. Without direct contact with respondents there is a lack of debriefing, which may be important where surveys have covered distressing topics. After submission a final page might provide sources of support, or contact details of the researcher in case they have any queries. Ethical issues are also raised by the 'harvesting' of information from newsgroup postings and individuals' webpages, when the information was not made available for such a reason. Where this approach has been used to compare bereavement reactions after different modes of death (Lester 2012), there are problems with the validity of such methods as well as the ethical concerns.

Tolerance

Just as recipients of postal questionnaires might become immune to junk mail, recipients of email invitations might also develop email-fatigue. Most students and staff in large institutions receive up to 2 email requests per day to participate in research. The impression is

that these are often deleted with only a cursory glance at the content, and that exposure to low quality questionnaires quickly extinguishes respondents' motivation to participate in that or subsequent surveys. Whilst this may also have been true of postal surveys pre-internet, the risk of email survey fatigue threatens the sustainability of the email sampling method. Any concession on the quality of survey questionnaires, or the smooth operation of the web programs on which they are delivered, also threatens the popularity of internet-mediated surveys.

Conclusion

Use of the internet to conduct cross-sectional surveys in mental health research is a growing practice. Many of the problems inherent to face-to-face survey methods, such as social desirability effects and the effects of researcher presence on disclosure, are reduced by the relative anonymity of internet methods. However this anonymity also creates its own problems, including specific biases and the inability to monitor respondent distress. By careful planning of sampling strategy and survey design, it may be possible to reduce these biases as well as the potential for causing distress, enabling a potentially cost-effective means of understanding psychiatric morbidity.

Declaration of interest: All authors declare that they have no conflict of interest.

Multiple-choice questions

1. Which of the following would not be possible using internet-mediated research methods? (answer: b)
 - a. Verifying whether a participant was intoxicated whilst responding.
 - b. Ensuring that a participant did not consult a friend whilst responding.
 - c. Recording the time of commencement and completion of a survey.
 - d. Detecting multiple submissions from the same participant.
 - e. Providing instructions in a choice of languages.

2. Harvesting of research data without direct consent would be unethical from which of the following sources? (answer: e)
 - a. Facebook public content
 - b. Twitter

- c. Web fora
 - d. YouTube
 - e. Personal emails
3. Which of the following factors are likely to improve response to an online survey?
(answer: b)
- a. low topic salience
 - b. gift voucher incentive
 - c. video instructions
 - d. detailed sampling invitation
 - e. tight response deadline
4. Which one of the following biases is minimised when using internet-mediated surveys? (answer: d)
- a. inductive bias
 - b. sampling bias
 - c. non-response bias
 - d. social desirability bias
 - e. healthy worker effect
5. Which one of the following is not likely to be a substantial cost consideration in internet-mediated cross-sectional surveys? (answer: b)
- a. consultation process
 - b. participant travel time
 - c. carbon emissions
 - d. lottery incentive
 - e. survey program

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