REVIEW

Web-based HIV/AIDS behavioral surveillance among men who have sex with men: potential and challenges

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Introduction

Successful HIV prevention among men who have sex with men (MSM) depends on changing risk behaviors that put them at high risk for HIV. This mainly includes increasing condom use, reducing the number of sexual partners, reducing needle-sharing behavior, and delaying the onset of first intercourse. In order to promote changes in the behaviors mentioned above, every country needs evidence-based information to guide the design of appropriate prevention programs and to monitor and evaluate whether these efforts are successful. Systematic surveillance of risk behaviors over time among MSM can provide important information for better understanding HIV/AIDS in the community, predicting incidence, and planning intervention programs.1,2

Public health surveillance is “the ongoing systematic collection, analysis, and interpretation of health data, closely integrated with the timely dissemination of these data to those providing the data and to those who can apply the data to control and prevention programs”.3 Therefore HIV/AIDS surveillance addresses systematic data collection and dissemination of data to those who need it so that action can be taken. However, since the advent of the HIV epidemic, the focus of HIV/AIDS surveillance has changed with the understanding of
HIV transmission. From early in the HIV epidemic, many countries have focused on HIV/AIDS case reporting, some developing countries, such as China, India, Thailand, and those in sub-Saharan Africa, have set up sentinel surveillance systems (sentinel surveillance addresses tracking the changes in HIV prevalence) following a recommendation by the World Health Organization (WHO). Because HIV prevalence reflects a cumulative HIV incidence and mortality, and will only slowly respond to changes in risk behavior, it may not serve as a good indicator of changes in new infections or as a measure of success of programs that are designed to reduce new infections. Hence, recently the Joint United Nations Program on HIV/AIDS (UNAIDS)/WHO HIV surveillance working group in collaboration with other international partners have advocated the implementation of ‘second generation surveillance’. One of the key features of this strategy is to address monitoring changes in risk behavior (behavioral surveillance) and patterns of other sexually transmitted diseases (STDs). However, behavioral surveillance among the MSM, which requires repeated cross-sectional surveys based on replicable study designs, is problematic in many countries. Common challenges include cultural and political barriers and the resource costs of surveying in traditional gay venues. These factors make it difficult for governments, researchers, and healthcare workers to access MSM, which affects the quality and completeness of behavioral surveillance.

With the development of new communication technologies, a new meeting place—the Internet—provides a perfect channel, a virtual venue, for MSM to seek sexual partners. The anonymity and complete privacy characterized by the Internet allows sex-seeking without discrimination and stigmatization associated with homosexual orientation. The anonymous and electronic nature of the Internet is useful in eliciting sensitive homosexual information, and also offers unique practical capabilities in conducting online surveys compared with conventional survey methods (e.g., the telephone, mail, and face-to-face interviewing). The Internet has opened up new vistas in the HIV/AIDS behavioral surveillance among MSM and shows great potential.

However, as behavioral surveillance requires consecutive behavioral surveys and stable sampling and study designs, the fluid nature of Internet MSM users may generate sampling issues. For this review Medline and recent AIDS conference publications were searched by using keywords ‘MSM or gay’, ‘Internet or Web’, and ‘HIV/AIDS’. Herein, we synthesize the literature to explore the necessity and challenges of using the Internet to conduct HIV/AIDS behavioral surveillance among MSM.

**MSM, avid users of the Internet for sexual purposes**

The Internet offers a limitless supply of potential respondents for researchers wanting to conduct web-based research. With up to 972 million individuals worldwide accessing the Internet each day (15.2% of the world population), it has become an important part of daily life in many countries: in North America 68.2% access the Internet regularly, the rate is 52.9% in Australia and 35.5% in Europe.

MSM are avid users of the Internet for sexual purposes because of the perceived anonymity, the availability of partners, and less discrimination and stigmatization of homosexuality in an online setting. A survey in London gyms showed that around one-third of 601 MSM with access to the Internet had sought sexual partners via the Internet in 2002; three years later this figure had increased to more than 50%. Furthermore, half of them indicated that they preferred to meet partners through the Internet rather than in bars or other offline venues. Seeking sex has become an important reason for using the Internet for MSM. An American study of clients attending STD clinics found that Internet sex seekers were more likely to be men and homosexual. Another large study in North America (4507 Internet users) found that those who had sought sexual partners through the Internet were more likely to be male and have same or both sex partners.

In China, there were more than 250 Chinese websites dedicated to gays, lesbians, and bisexual people (gay websites) in 2001. By the end of 2004, the number of people accessing broadband connections increased to 94 million, which represents an increase of 18.2%, or 14.5 million new users compared with 2003.

**The Internet, a new emerging risk environment for MSM**

With more and more MSM seeking sexual partners through the Internet, the Internet has been characterized as a “new emerging risk environment for HIV/AIDS” for MSM. Nearly all relevant studies suggest that MSM who seek sex through the Internet are at a higher risk for STDs/HIV than those who do not, although the elevated risk associated with sex-seeking on the Internet is measured by a variety of indicators depending on different research designs and methods. Internet sex seekers are more likely to have an STD history, practice unprotected anal intercourse, and have a higher number of sexual partners. Does the excess risk for STDs/HIV faced by Internet sex-seekers necessarily come from the sexual partners met through the Internet? Or does the association simply reflect that those with high-risk sexual behaviors selectively use the Internet to seek partners? Although current studies cannot provide solid evidence to clarify the causal relationship between using the Internet and higher risk sexual behavior, the results do indicate that the Internet has become a new risk venue for MSM and an avenue for risk surveillance.

Behavioral data can be collected in many ways depending on the nature of the health event under consideration. Since it is clear that the Internet has become a risk venue for the MSM population, surveillance should be put where the risk is. Web-based behavioral surveillance can help health professionals to collect more specific information on the incidence and risk context of disease transmission that is linked to the Internet. It not only can help to explore the changes in risk behaviors, but can also help to determine who is most at risk of contracting or passing on HIV infection, and what role the Internet is playing and how risky the Internet is in the transmission of HIV.

**Effective recruitment approaches**

The Internet provides effective avenues to recruit study subjects. Several methods have proved to be more efficient
for recruitment than traditional epidemiological investigation methods. Posting banners or pop-ups on gay websites with links to the study website is a very common online recruitment tactic. An American online study recruited 628 gay men within one month by establishing a link from gay websites to the data collection site. A study conducted in London in 2002 recruited gay men by building a pop-up and banners in the chat rooms and personal profiles on ‘Gaydar’ and ‘gay.com’, two of the UK’s most popular gay websites; 1250 respondents completed the questionnaires within four weeks. Using the same method, other investigators have also effectively recruited gay men of particular racial or minority groups.

Sending an e-mail to the registered members of gay websites is another efficient way to recruit respondents. An invitation e-mail can be distributed to registered members by webmasters. One big advantage of this method is that researchers are able to calculate the response rate, which helps to assess the potential selection bias, the most common bias from online surveys. However, this might raise ethical issues that will be discussed below.

Having a web page presence and chatting with chatters can also be viewed as useful methods to recruit subjects. It is not difficult to establish a web page that explains the purpose of the survey and invites the target population to participate. However, attracting enough respondents within a designated period might be a challenge using these methods alone. They are probably best pursued in conjunction with e-mail or banner recruiting. In order to increase the response rate, providing a small financial reimbursement for a participant’s time may be helpful.

**Practical advantages of online surveys**

Compared to other survey methods, the Internet provides a more convenient approach to collect and collate data. Almost all traditional field surveys including mail, telephone, pen-and-paper, or interviewer-administered questionnaires will eventually be transferred into electronic data for analysis. In online surveys, however, questionnaires written in hypertext mark-up language can be posted on the Internet with a visually friendly display. The completed questionnaires can then be transferred directly to relevant statistical software. The electronic nature of the data also allows researchers to modify the questionnaire easily when mistakes are identified or to add more questions when more information is needed. It can also produce tailored questionnaires for specific respondents and automatically skip questions that do not need an answer.

One of the greatest advantages of web-based surveys is that they allow respondents to answer questions anonymously and therefore maintain their privacy. The possibility exists of identifying Internet Protocol (IP) addresses and tracking their personal information. However, emphasizing the credibility of researchers and guaranteeing no IP identification during the investigation may reduce such concern. Additionally, online surveys can reduce social desirability bias caused by attempts to satisfy the interviewer’s expectations or being led by the interviewer’s verbal expressions.

Another important advantage of the online survey is its cost-effectiveness. This is especially important for HIV behavioral surveillance in developing countries. Compared to traditional field survey methods, online surveys reduce the costs of printing, stationery, and postage. There are no data entry costs and no data entry errors. In addition, online surveys do not need to arrange face-to-face interviewers thus reducing expenses for transportation and compensation. Once the study site is set up, there is almost no other cost related to online surveys.

The Internet appears to offer an ideal medium to conduct HIV/AIDS behavioral surveillance among MSM. However, given the facts that the main function of behavioral surveillance is to track the changes in key risk behaviors over time and systematic and replicable study designs are required, there are several issues that should be kept in mind when using the Internet to conduct behavioral surveillance among MSM.

**Issues of sampling and study design**

Given the fluid nature of the MSM community of Internet users and the sensitivity of homosexuality, it is almost impossible to develop a sampling frame to yield an online sample of MSM based on a randomized probability principle. The convenience sampling design, the most common strategy used in web-based surveys among MSM, may limit the generalization and interpretation of surveillance results. Usually in an online survey among MSM, advertisements are posted widely on gay websites or chat rooms to recruit potential respondents. For specific gay websites, lists of ‘user names’ and/or e-mail addresses of registered gay members do exist, however it may be difficult for researchers to access them because of privacy concerns. Even if a list of e-mail addresses is obtained, it is still difficult to construct a random e-mail address list given the mixed quality of the list of e-mails provided by MSM Internet users. The sampling issue is probably the biggest challenge to conducting methodologically socially behavioral surveillance among MSM using the Internet.

Furthermore, regardless of the methods used to recruit potential respondents, participation is always based on the willingness of potential target populations. What is different between those who take part in the study and those who do not? What drives those MSM who access the invitation advertisements to participate? To date there have been no such studies that could answer these questions and clarify the potential selection bias associated with online samples. Offering an incentive may increase the participation rate. The problem with offering a direct monetary reward or using a lottery system is that it requires participants to reveal their identities so that the reward can be delivered. An online experiment, however, indicates that incentives do influence drop out, but not initial interest in participation, and do not alter how participants answer the questions.

In addition, it is also assumed that in developing countries young and well-educated people may account for the majority of Internet MSM users. It is likely that young and well-educated MSM possess more computer literacy or have more ready access to personal computers than older MSM.
Although the world is experiencing a rapid increase in the use of the Internet, in countries without good computer infrastructure, or where literacy is a problem, surveillance using web techniques is not possible. It is also very difficult to calculate the response rate because of the difficulty in identifying the denominator. Because web servers can automatically record the number of visits, it is possible to have a rough estimate of non-participants by subtracting off the respondents, as well as to calculate the individuals who visit the websites but do not participate. The problem with this calculation is that 'hits' that a website receives are different from individuals who visit it. It is difficult to ascertain a subject’s motivation for ‘hitting’ a website and to determine whether he is eligible for a study.

In terms of the representativeness, online MSM samples are only samples of MSM who use the Internet. Internet-based surveys cannot reach the whole MSM population. However, sampling in surveys among the MSM population is a common challenge for both online and traditional gay community surveys. Most current participants in surveys among MSM are self-selected rather than probability samples. For example, the survey conducted in London, as a part of an annual behavioral surveillance program among MSM, distributed questionnaires in London gyms. Those MSM who saw the questionnaire and wanted to participate were expected to complete the self-administered questionnaire. No special sampling design was employed. Other MSM studies, which recruited participants from gay bars, from a gay pride festival, and from public health counseling and testing sites, have similar limitations.

Family Health International summarized sampling methods for behavioral surveillance among MSM, including multi-stage cluster sampling, time location sampling, the ‘take-all’ approach, and ‘snowball’ sampling, which are usually applied to MSM in traditional gay venues. The first two methods are less prone to bias and permit the application of statistical theory to estimate the sampling error from the survey data themselves. However, to use these methods one needs to develop a detailed sampling frame of venues where gay men tend to gather, which takes time and resources and is rarely satisfiable. In addition, community MSM samples are restricted to the subgroup of MSM who frequent traditional gay venues. This group may be less representative of the (whole) MSM population than an online sample. The other two methods, which are similar to the convenience sampling design, are not based on a probability principle. They are generally easier and inexpensive to use, but selection bias may still be an issue from the subjectivity that often enters into the sample selection process, and the replicability of the sampling process is still a challenge. A new form of chain-referral sampling termed ‘respondent-driven sampling’ has been developed by the Eastern Connecticut Health Outreach project for surveys among ‘hidden populations’. One of the key features of this method, distinct from the traditional

<table>
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<td>Ross et al. (2000)</td>
<td>Sweden</td>
<td>Questionnaires were launched on the homepage of the most popular Swedish gay website (N = 678)</td>
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<tr>
<td>Rhodes et al. (2002)</td>
<td>Birmingham, USA</td>
<td>Establishing links with gay websites, as many as possible (N = 383)</td>
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MSM, men who have sex with men; STD, sexually transmitted disease; UAI, unprotected anal intercourse.
snowballing, is to rely on a dual incentive system — an incentive for participation plus a reward for recruiting a certain number of others into the study — to reduce the selection bias towards the initial subjects. This feature makes it less feasible in developing countries because of the prohibitive expense involved. And also this method may take a long time to reach the target sample size.

Several studies have explored differences between online MSM samples recruited using convenience sampling designs and samples recruited in traditional gay venues.22,29,36 The major findings are summarized in Table 1. Although there is consistent evidence that individuals from online samples are more likely to have lower education and to be bisexual, no clear differences in demographic characteristics and risk behaviors between the two different sources of samples are apparent. The problem with these comparisons is that there are other differences between the two samples besides the method by which the data are collected. None of the studies have used probability-sampling methods, and the bias associated with self-selection is not clear. Given cultural, religious, and economic situations and attitudes to homosexuality in different countries, it is difficult to draw a clear conclusion as to the differences between online and community MSM samples. These studies, however, potentially do indicate that online surveys can produce similar quality data to the surveys conducted in traditional ways, and the Internet may serve as an expedient and reliable method to increase the understanding of risk among MSM.22

The sampling issue is generic to all surveys among MSM and does not pose a particular problem on the Internet. In fact due to the ease and the anonymity of answering, this self-selection bias is probably minimized. Increasing the sample size, which is highly possible in an online survey, and using multiple recruitment methods to maximize the diversity of potential respondents, can significantly reduce selection bias. Selection bias might be decreased as more and more people can access the Internet in the future. In addition, online surveys may potentially reach many MSM who do not frequent traditional gay venues and cannot be recruited for the community-based surveys.22 Monitoring key demographic characteristics of an online MSM population may help evaluate any potential selection bias. Changes in the demographic composition of online MSM samples over time may highlight a need for statistical adjustment, or differences between participants and non-participants may point to the potential direction of any bias.22

In addition, the key purpose of HIV/AIDS behavioral surveillance, an important part of an HIV/AIDS comprehensive surveillance system, is to track the changes in risk behaviors that put MSM at risk for HIV. The surveillance methods are defined more by their ‘practicability, uniformity, and rapidity’ than their ‘completeness and accuracy’. Sample frames and randomness may not be as crucial as one may think. In terms of routine surveillance, the more complicated the process is, the less precise the results, especially in developing countries. In certain circumstances it is not necessary to create representative samples of the whole target MSM population in the behavioral surveillance. As long as the same sampling design is used between survey rounds and any bias caused by online sampling can be assumed to be relatively stable, samples of sub-groups of MSM still provide valuable information about the trends of risk behaviors.

Conclusions

Sampling and study design should be carefully considered when using the Internet to conduct HIV/AIDS behavioral surveillance among MSM. However, this method can still be viewed as an efficient and feasible approach for such surveillance, especially in countries where the HIV/AIDS epidemic is concentrated in high-risk populations and where the conducting of such behavioral surveillance in traditional gay venues is difficult. With progress in technology, many issues related to online surveillance may be solved. The Internet, as a new sexual networking venue for MSM, presents a compelling channel to develop new methods in HIV/AIDS risk behavioral surveillance among MSM.

Conflict of interest: No conflict of interest to declare.

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