Using the internet to conduct research

The internet has become an everyday communication tool for countless people throughout the world. It has a variety of potential uses in education, practice and research, but only in the last decade have nurse researchers begun to take advantage of the multiple uses the internet has to offer. The author reviews the uses of the internet to conduct research and addresses challenges and issues that currently influence web-based research.

Introduction
The establishment of the internet, specifically the world wide web (WWW), as an everyday means of communication has significantly enhanced interaction among individuals and groups in all areas of life (Strickland et al 2003). Prior to the mid-1990s, researchers who used the internet primarily did so to access information for more traditional research purposes such as emailing, electronic mailing lists, Usenet newsgroups, specialty search engines, metasearch engines, and website directories on the WWW (Duffy 2002). In recent years, the explosion in use of the internet has offered more opportunities to the researcher (Box 1) by providing a new environment for conducting web-based research.
### Box 1. Summary of advantages of using the internet for research

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<tr>
<th>Advantages for researchers</th>
<th>Sources</th>
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<td>Advantages for study subjects</td>
<td>Sources</td>
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<td>-------------------------------</td>
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<tr>
<td>Allow participants to respond at own pace, when appropriate</td>
<td>(Bowker et al 2004, Rhodes et al 2003)</td>
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<tr>
<td>Perception of control by study participants</td>
<td>(Barry 2001)</td>
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<td>More interest in participating (novel and creative)</td>
<td>(Barry 2001, Schwarzer et al 1999)</td>
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<th>Advantages for research students</th>
<th>Sources</th>
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<tr>
<td>Good medium for students to learn and use</td>
<td>(Rhodes et al 2003)</td>
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Because of its graphical user interface and capability to integrate images and sounds, the internet can produce a more intuitive and rich context for research opportunities (Duffy 2002). With seemingly endless advances in web-based technology and increasing numbers of internet users, researchers have online access to diverse populations, including those that are otherwise hard to reach.

The internet has offered many new opportunities to researchers in a variety of disciplines. Web-based research involves a number of internet capabilities researchers can exploit to plan and/or implement a research study, and offers advantages of cost, speed and access over more traditional paper-and-pencil procedures. According to Duffy (2000a, 2002), a typical web-based study involves the development of a specially designed web page containing a survey or questionnaire for completion by a specifically selected population. In addition to data collection, researchers and scientists have found this type of research useful for:

- virtual focus groups (Adler and Zarchin 2002, Moloney et al 2003)

**Literature analysis**

Although still in its early stages, the internet presents an unparalleled breadth of opportunities for the collection of data from populations of interest in a cost-effective and resourceful manner (Duffy 2000a). Uses of web-based research can be found in the literature, although many of the selected articles do not describe methodological examples, but instead appear to focus on current issues and challenges with the use of this fairly new technology.

A literature search was conducted using the key words internet and data collection or research in the databases of EBSCO and PubMed, which resulted
in approximately 25,000 and 700,000 hits respectively. After accounting for duplications and applying limiters (such as ‘humans’, ‘most recent five years’, and ‘English language’), over 60 articles were secured. Of these, 48 (including one from an earlier date) were selected for review.

The selection was primarily based on the fact that these writings contained discussions about the benefits and limitations of the use of the internet for conducting research. In addition to journal articles, one website retrieved through the Google search engine was also selected, as it added information on ethics not fully addressed in the articles.

Although the articles reviewed were from the disciplines of nursing, medicine, psychology, allied health, sociology, education, information management, business and government, the researchers’ evaluations of the use of the internet for data collection were remarkably similar. They cited similar advantages, namely cost, ease of use, and access. They also found many of the same issues and challenges (for example, security, confidentiality and response errors), and many authors offered recommendations for minimising the challenges of web-based research.

**Uses of web-based research**

There are a number of ways to conduct internet research. In addition to establishing communication with authors of research studies, searching the internet and a variety of databases, collaborating on a journal publication with a colleague, or submitting an abstract for a conference, there are numerous examples in the literature documenting the uses of web-based research activities.

Senior (1999) divided internet usage into three categories:

- use as a resource locator
- use to complete demographic surveys
- use for empirical investigations.

The typical way in which internet research is conducted includes recruiting subjects and directing them to an online site where they post on a discussion board or complete a survey. The data are then transmitted to the researcher via email or through data files maintained by their web server (Eaton et al 2002). Nurse researchers have just begun to use the internet for empirical
studies, so the use of the internet as a data collection method and the practical issues it raises are areas of rich research potential (Senior 1999).

Eysenbach et al (2001) suggest that qualitative analysis of material published and communicated on the internet can serve to systematise and codify needs, values, concerns and preferences of consumers and professionals relevant to health and health care. The authors cite three different types of internet-based research methods, which include:

- passive analysis (studies of information patterns on websites or interactions on discussion groups without the researchers being involved)
- active analysis (researchers participate in communication)
- researchers identify themselves as such and gather data.

While most of the literature explores the use of the internet for data collection (Im et al 2004a, 2004b, Lakeman 1997), the use of focus groups (Adler and Zarchin 2002, Lakeman 1997, Maloney et al 2003), and the issues and challenges encountered (Im et al 2001, 2003, 2004a, 2004b, among others). Chen et al (2001) used internet services to generate a research sampling frame for an ongoing pilot study conducted to evaluate psychometric properties of one of the author’s needs assessment instrument for nursing homes. The authors concluded that using the internet for this research activity was convenient and appropriate for the sample selection of specific study populations. Further analysis of the literature reveals numerous advantages and disadvantages of this technology.

**Advantages of web-based research**

Web-based research provides many advantages. Access to specific populations is quick, cost-effective and efficient (Duffy 2000, Maloney et al 2003, Rhodes 2003, Wilson 2003). In addition, access to hard-to-reach populations can be enhanced (Eaton et al 2002). Yeaworth (2001) was able to find and gather data from a sufficient number of subjects suffering from a rare disorder, Pick’s Disease. Without the internet, this research opportunity may have been difficult to accomplish. Likewise, in their study of gay and lesbian subjects, Koch et al (2001) evaluated potential issues with online data collection when comparing their survey results to national data, finding that their data compared favourably to the existing national data.
Social scientists are becoming more interested in studying the attitudes, values and behaviours of members of vulnerable populations. The internet offers a more feasible option than traditional survey methods for research with these populations, largely due to the population pool and perceived sensitivity of subjects. The internet also offers increased participant comfort (Adler and Zarchin 2002, Barry 2001, Bowker et al 2004) and motivation (Barry 2001, Gosling et al 2004) to participate in the online study because of anonymity.

The internet provides an ideal medium for data collection for children. Although not specific to data collection on the internet, Kennedy et al (2003) studied the use of interactive gaming to obtain paediatric research data. They used laptop interactive data collection (IDC) software for a children’s health intervention study. Using this methodology (IDC technology, developmental needs of children, and engaging quantitative research methods), the researchers addressed common problems while potentially increasing participant response rates and reducing missing data (Kennedy et al 2003). Research studies using IDC computer technology with children may have the potential to be as successful with research on the internet.

**Issues and challenges of web-based research**

Nurse researchers who use web-based research must consider the ethical and methodological issues and challenges associated with its use (Box 2). Although the internet can increase access to a larger population group, it may not represent the national population profile, consequently threatening validity and generalisability of study findings (Duffy 2002, Eaton et al 2002, Im et al 2001, 2003, 2004a, 2004b, LaCoursiere 2003, Strickland et al 2003).

Potential selection bias of participants is a major challenge for individuals conducting research on the internet. Typically, the sample pool includes people who own a computer or have access to one, are ‘white collar’ (middle class), better educated, technologically aware and urban, which may limit generalisability (Daley et al 2003). Numerous researchers across disciplines, however, have found no differences in data collected from internet research compared to paper-and-pencil data (Barry 2002, Birnbaum 2004, Bliven et
<table>
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<th>Limitations for researcher</th>
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<tr>
<td>Possible survey error due to complex design</td>
<td>(Daley et al 2003, Granello et al 2003, Stewart 2003)</td>
</tr>
<tr>
<td>Limited international scope</td>
<td>(Rhodes et al 2003)</td>
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<tr>
<td>Competition for attention</td>
<td>(Rhodes et al 2003)</td>
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On the other hand, researchers in the behavioural sciences have deemed online interviews to be an effective and appropriate approach for accessing discourse about experiences of people of special populations (Bowker et al 2004) and in a

| Professional barriers (e.g. internet credibility) | (Duffy 2000a) |
| Possible data entry errors | (Im et al 2004b) |
| Limitations for study subjects | Sources |
| Decreased accessibility to internet during peak high volume times | (Matthews 1999) |
| Literacy and disability issues | (Rhodes et al 2003) |

Professional barriers (e.g. internet credibility)
Possible data entry errors
Limitations for study subjects
Blurring of public and private boundaries on the internet (including privacy and confidentiality issues)
Decreased accessibility to internet during peak high volume times
Literacy and disability issues


Closely related to these concerns are those about privacy and confidentiality. All research studies, including those involving web-based research, require protection of human subjects. Research in cyberspace is somewhat different, it poses additional threats as internet communications leave a physical record that can be archived or otherwise preserved (Frankel et al 1999, Im et al 2003, 2004a, 2004b, Norris 1999). Another type of privacy and confidentiality issue involves the quoting of participant statements. Even if the researcher removes identifying information, it is possible to locate the sources of the statement (with screen name and/or email address) through one of the search engines (Eysenbach et al 2001). In addition, by quoting another’s work without permission, a researcher may be misusing the person’s intellectual property (raising copyright issues). These are examples of violating a potential subject’s privacy and confidentiality rights.

A major issue related to these matters concerns questions about whether the online environment is public or private in nature. There appears to be some confusion as to whether internet communities are public or private spaces. The issue here is that if the information given by the participant was provided in a ‘public’ place, informed consent is not necessary. For example, information given in public meetings is provided because the individual is seeking public visibility and therefore no institutional review board (IRB) approval would be required. According to Eysenbach et al (2001), although posting or publishing on the internet is similar, people posting cannot always be assumed to be seeking public visibility. They further suggest that if a subscription and registration is necessary to access the internet community, this should be considered a private place.

The number of users can help the researcher determine if the site is private or public (the greater the number, the more likely it is to be public). Yet this can be ambiguous – archived data can increase numbers, making the real number of individuals difficult to determine. Last, the public or private nature of the site may be determined by the rules or codes of the community, a site for sick children, for instance, posts rules that spell out that the site is for children only (Eysenbach et al 2001).
Privacy and confidentiality issues are not just the concerns of science disciplines. Business communities are increasingly becoming more aware of the ethics of data collection. Although not used for ‘scientific’ research, data collected from consumers are being used by companies and sold to others to learn more about their customers (Harter 1999, Sipior et al 2004). Increased interest in potential abuses of such data may filter over to affect the credibility of and use of the internet for data collection for health-related studies.

Additionally, researchers are concerned with measurement issues related to data collection on the internet. Based on their research, Strickland et al (1993) raised concerns about the following issues:

- selecting and designing internet data collection protocols that adequately address study aims while taking advantage of internet capability
- ensuring the reliability and validity of internet data
- adapting quantitative paper-and-pencil data collection protocols for the internet
- making internet data collection practical for respondents and researchers
- ensuring the quality of internet data collected.

Other researchers, however, have determined that if the online survey instruments are designed appropriately for the web environment, they are practical and efficient (Aladwani and Palvia 2002, Chen et al 2001, Daley et al 2003, Meyerson et al 2003, Schwarzer 1999). These researchers include recommendations for minimising measurement issues.

Technical issues of website development and maintenance (Im et al 2003, 2004a, 2004b) and data entry and analysis (Im et al 2004a, 2004b) pose additional concerns for accuracy and reliability. The construction of instruments for use on the internet is a complex procedure. Constructing web forms for data collection takes time, as the questions must have clarity and flow, the form must work across all web browsers and must be accessible to likely respondents regardless of computer expertise, and security of data must be assured (Wilson 2003).

Despite the limitations of web-based research, there are numerous advantages. It is important that the researcher weighs the risks of the limitations against the benefits. Boxes 1 and 2 (above) offer summaries of the advantages and limitations of using the internet for research.
Implications for research, education and practice

Research implications
Malone (2000) states: ‘It is always challenging to try to make sense of that which fundamentally changes the way we do things.’ The ‘way we do things’ can hold us back, dissuading us from ever venturing forward to try the new technology. Is it not reasonable to suggest that the internet will, in fact, make us think ‘out of the box’ and change the way we do things?

The internet offers many opportunities to the researcher. It can assist him or her in:

- planning research studies
- developing research methodologies
- locating resources
- accessing diverse populations
- conducting quantitative and qualitative research studies.

Web-based research can be less expensive than paper-and-pencil survey methods, and it provides a potential pool of a greater number of study participants, including the hard-to-reach populations of interest. Although some issues and challenges confront nurse researchers pursuing web-based research activities, the benefits are likely to increase its use. Many researchers across disciplines have recommended support in favour of internet research and have found no difference in data collected from internet research as compared to paper-and-pencil data.

Education implications
There is a number of applications for this type of research in education. Students of many disciplines can gain skills in computer literacy and online research methodology. Working with an experienced researcher will help to prepare the student to conduct research on the internet. This raises questions about the possible inclusion of internet-based data collection methods in graduate education to better prepare future researchers for this type of research design.

Practice implications
Practice implications include the need for healthcare providers and social
scientists to be more knowledgeable about the use of computers and accessing the internet. Their contact with patients and consumers of health care make these individuals responsible for teaching skills to others. In addition, as consumers of research, they need to be able to transfer findings of research, regardless of methodology, to practice settings.

**Future directions**

Future directions must include the development of guidelines for ways to deal with legal and ethical issues, computer and web site development and maintenance issues, and recruitment issues (Duffy 2000a, 2000b, 2002, Ellett et al 2004, Im et al 2004a, 2004b). Recommendations have been made by researchers for ways to improve the conduct of research on the internet.

Chen et al (2001) and Daley et al (2003) suggest that pilot testing of online instruments can help to improve designs to make them more user-friendly. Use of instructional design and technology consultants can assist the researcher to accomplish this. Roos (2003) insists that methods to improve subject recruitment can assist researchers in decreasing reliability and validity problems. Eysenbach et al (2001) suggest that researchers should consider all aspects of privacy and confidentiality, including potential risks and benefits, when conducting internet-based research. They propose considerations for researchers and IRBs before studying an internet community.

Ethical guidelines are not fully addressed in the codes of professional organisations. There is a need to further define the distinction between private and public behaviour in internet use, ensuring methods for obtaining valid informed consent from participants and verifying the validity of data collected via the internet (Im et al 2004a, Pittenger 2003).

**Conclusion**

The results of this review indicate that despite some limitations, the internet can be a valuable medium in reaching increased populations, especially those that are difficult to identify using standard methods. This can be done faster, cheaper and more easily than by the traditional paper-and-pencil means.

The advantages of using the internet appear to outweigh the limitations (see appendices 1 and 2) by offering many new opportunities for researchers
to conduct quantitative and qualitative research. The internet changes everything we do and offers so much potential for the future. In time, more and more nurse researchers and researchers of other disciplines will accept this technology as leading the way in this new age of research.

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