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A Primer on Technology-Based Health Promotion

CHAPTER OVERVIEW

This chapter introduces readers to the use of computers, the Internet, mobile phones, and mobile devices in health promotion. We offer specific examples from a growing body of literature that illustrate *how these modalities are unique and different from traditional health promotion efforts.* We also offer examples from the literature that illustrate the challenges we face with technology-based health promotion. This dynamic field has offered us several programs that we can highlight as current "best practices," and we will describe these as well. In this section, we will also consider the role of theory in technology-based health promotion, offering a conceptual framework to link the unique aspects of this field to health promotion generally. Finally, we consider emerging trends in technology-based health promotion. After reading this chapter, the reader should be able to (a) summarize unique elements of technology-based health promotion; (b) identify current "best practices" in computer, Internet, mobile phone, and mobile devices to promote health; (c) describe limitations to technology-based health promotion; (d) identify theoretical concepts that should be considered in development and implementation of technology-based health promotion efforts; and (e) describe emerging trends in the field.

WHAT IS UNIQUE AND BENEFICIAL ABOUT TECHNOLOGY-BASED HEALTH PROMOTION?

Efforts to promote health are obviously not new. We emphasize that our role in this textbook is not to describe health promotion generally but rather to consider what is *unique* and *different*

that technology can add to our efforts to promote health. In this segment we consider these unique features of technology-based health promotion by reviewing selected publications that exemplify this point. Text Box 1.1 identifies the key unique elements of technology-based health promotion we describe in this chapter, and the Appendix (p. 236) offers a brief review of selected technology-based health promotion programs that exemplify the points we make in this chapter.

Reaching Larger Numbers With Health Promotion Programs—Including Disadvantaged and Marginalized Groups

One of the most significant contributions technology-based health promotion programs offer is *reach*. The Internet offers unprecedented opportunities to reach large numbers of people with health promotion programs. With the advent of the Internet (aka the World Wide Web) and browsers designed to search webpages, health promotion entered a new era. The Pew Internet & American Life Project reported that in 2000, there were 52 million Americans who had gone online seeking health information; that number had risen by 2002 to 73 million and by 2006 to 113 million (Fox & Rainie, 2000; Horrigan, 2004; Pew Internet & American Life Project, 2006).

Whereas computers could be used effectively by health care providers to promote health in clinic settings, individuals could now be proactive in seeking health information, and could do so in the privacy of their own homes, on their own time. Programs can now be delivered to people outside traditional clinic, educational, and social service settings, and therefore, they may have the potential to reach people who do not have access to any of these settings.

There remains evidence of a digital divide; that is, poor persons and persons living in resource-poor settings do not have equal access to the equipment used for technology-based health promotion or the levels of bandwidth required to deliver high-quality and graphic-rich content. This suggests that technology-based programs may actually be problematic in that they could bias the delivery of programs to those with computer access and high-speed Internet access. We further discuss this particular limitation of technology-based health promotion in the section on "bias and the ongoing digital divide" below. Of note, however, is recent evidence of a reverse digital divide—wherein lower-income populations and those residing in resource-poor settings are among the fastest-growing consumers of mobile phones, airtime minutes, and text messaging (Cellular-News, 2006). When we consider reach with technology-based health promotion, it is certainly valuable to consider the possibility of even greater penetration and reach into potentially higher-risk groups using mobile phones. Chapter 8 focuses specifically on case studies of health promotion using mobile phones.

Why is reach in health promotion of such critical importance? Consider the classic argument of public health impact. Our health promotion programs are often evaluated to determine if they work—or whether they have *efficacy*. Public health researchers are also concerned about other factors, including whether they can work for a large and diverse number of people—that is, whether they are *effective*. Ultimately, if programs have a high degree of efficacy but they work for only a small number and/or select group of people, they

TEXT BOX 1.1
What is *unique* about technology-based health promotion?

Unique element	*Why technology-based programs differ from traditional health promotion*	*Examples of this element from technology-based health promotion*	*Examples of this element from traditional health promotion*
Reach	• Technology-based programs have the potential to reach many more people than could be served in traditional programs. • People aren't required to travel to a site to participate and can access it outside traditional educational or social service settings.	(Gustafson et al., 2002)	Providers work to adapt their programs to make them more appealing to target audiences at elevated risk—for example, Latinos facing high morbidity related to diabetes (Eakin, Bull, Glasgow, & Mason, 2002).
Standardized information	• Technology-based programs' content is delivered in exactly the same way each time to every user. • Technology-based programs aren't dependent on the personality or charisma of one individual to deliver content.	(Siek, Khan, & Ross, 2009)	Project RESPECT, a two-session counseling program with demonstrated efficacy for reduction in STD (sexually transmitted disease) risk behavior and related STD infection, is designed to be delivered by staff trained in client-centered counseling. The program will differ depending on the quality of the training and the individual skills of the staff members (Kamb et al., 1998).
Tailoring	• Technology-based programs can take specific information offered by a user and generate responses, using preprogrammed algorithms that are crafted for the individual.	The Wyoming Rural AIDS Prevention Project involved a multisession interactive Internet program for men who have sex with men to address issues related to HIV prevention. Users could choose to role-play situations related to HIV risk that was most salient and relevant to them, and	The Safe in the City video project, while demonstrating efficacy, was designed to target specific risk groups but did not tailor information. Rather, persons watching the video saw information specific to topics such as condom negotiation, skills in condom use, and disclosure of STD infection to

Unique element	*Why technology-based programs differ from traditional health promotion*	*Examples of this element from technology-based health promotion*	*Examples of this element from traditional health promotion*
	• Traditional health promotion programs can do this as well—consider, for example, the counselor who tailors eating recommendations to an individual—but such efforts cannot be widely standardized or replicated.	they could avoid role plays related to situations that were not relevant (Bowen, Horvath, & Williams, 2007).	partners. Viewers could not choose a particular segment they wished to watch (Warner et al., 2008).
Interactivity with computerized device	• Technology-based programs allow for users to get instant feedback and interact with a computer. While traditional programs allow for interaction with other people, technology-based programs allow for interaction with computers and people simultaneously.	While successful traditional programs utilize interactivity to deliver content, computers can use such attractive features as video games, multiplayer games, and large-scale contents. For the younger generation dubbed "technology natives," this can be of particular appeal (Crutzen, Brouwer, Oenema, Brug, & de Vries, 2008).	Evidence suggests that dynamic, engaging material is critical to facilitate efficacy in health promotion. Traditional programs rely on real-world interactivity with other group members, games, and stimulating discussion (Ramirez et al., 1995; Veazie et al., 2005).
Privacy	• Programs with sensitive information or information about health that individuals may not wish to disclose to anyone else can be delivered using technology. • Evidence shows that participants may be more willing to disclose sensitive information when interacting with a machine.	Studies intended to deliver sensitive information are effective in reducing symptoms of depression while maintaining participant privacy (Christensen & Griffiths, 2002).	Group-level interventions where participants meet weekly to cover health promotion content have been shown to have efficacy for health promotion. However, everyone in the group is privy to information about other participants in the group. This can affect levels and intensity of participation, especially if programs rely on disclosure of personal or sensitive information (Eakin, Glasgow, & Riley, 2000).

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Unique element	*Why technology-based programs differ from traditional health promotion*	*Examples of this element from technology-based health promotion*	*Examples of this element from traditional health promotion*
Autonomy	• Participants in technology-based programs can have the option of choosing program elements that are relevant and appealing to them. Traditional programs may often require users to complete elements in a particular sequence. • Technology-based programs are "always on," allowing access at any time of day or on any day of the week that is convenient to the user.	(Levine, Madsen, Barar, Wright, & Bull, 2009)	Delivery of programs with proven efficacy require participants to attend sessions that are delivered on a specific day of the week and at a specific time of day (Diclemente et al., 2004).
Portability	• Technology-based programs can be ubiquitous and portable if available on a laptop or mobile phone.	Recent innovations in the delivery of health promotion programs using mobile phones—for example, the STOMP smoking cessation program described in more detail in Chapter 8—can be accessed anytime and anywhere a person can use a mobile phone (Rodgers et al., 2005).	Traditional smoking cessation programs with counseling, while demonstrated as effective, still require users to attend sessions in person at a physical location.
Potentially lower program costs	• If technology-based programs reach greater numbers of people, can be standardized, and can be delivered at any time in diverse locations, we have the potential to lower the program costs associated with delivering health promotion.	This pilot study of an Internet-based weight loss program was more cost-effective than other information delivery channels (Booth, Nowson, & Matters, 2008).	(Glasgow, Klesges, Dzewaltowski, Estabrooks, & Vogt, 2006; Linke, Murray, Butler, & Wallace, 2007).

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will have less impact. Programs that may have relatively lower efficacy but whose effects can be realized by larger and more diverse groups of people will have greater impact overall. This impact is of critical importance, because without it, we cannot hope to affect reductions in morbidity and mortality and improve health.

Several researchers have paid close attention to public health impact. Thyrian and Ulrich (2007) argue that a program that can produce an effect on a specific behavioral outcome such as smoking will not necessarily have a substantial impact on smoking prevalence in the population or subsequently on smoking-related morbidity unless it can be designed to reach many people and unless those people can remain engaged with the program over time. Other researchers emphasize the same—unless we can reach large proportions of the audience targeted for a health promotion endeavor, they argue, our program will have limited impact regardless of efficacy (Glasgow, Klesges, Dzewaltowski, Estabrooks, & Vogt, 2006; Klesges, Estabrooks, Dzewaltowski, Bull, & Glasgow, 2007). Glasgow and colleagues take this argument further—they also consider that reach to individuals is indeed critical for program impact, but in addition, they consider that in order to achieve improvements in reach we need to make programs easy for organizations and communities to adopt and to implement. It isn't enough to reach large proportions of a target audience; in order to sustain program effects over time, you must ensure that organizations coming in contact with a target audience can easily adopt and implement a program (Glasgow, Lichtenstein, & Marcus, 2003).

How exactly would this be relevant for a technology-based health promotion program? Using technology in health promotion certainly has potential for reaching many more individuals than may otherwise participate in traditional face-to-face programs in clinics, schools, and community settings. Using technology could also be appealing for organizations in that technology-based programs (such as a CD-ROM or Internet program) may require fewer human resources to implement than other programs (e.g., a six-session group counseling program for weight loss may require personnel time and clinic space; a similar CD-ROM program only would require a computer and perhaps a short amount of staff time to introduce and orient a patient or participant to the program).

Thus, while it is of course important that our programs show positive effects, it is only by disseminating these effects widely that we will achieve our goals of health promotion and disease prevention. The importance of program *reach* cannot be overstated (Glasgow, McKay, Piette, & Reynolds, 2001). Consider the following references for a more detailed exploration of public health impact (Dzewaltowski et al., 2010; Klesges et al., 2007; Thyrian & Ulrich, 2007); included in these resources are specific calculations for quantifying the impact of a program.

Standardizing Information

Another advantage offered by technology-based health promotion is that of standardization in program delivery. By offering health promotion via computers, early innovators in this area were able to demonstrate fidelity and standardization as key advantages in the use of technology. Because program content is delivered in the exact same way each time, it removes reliance on individuals for health promotion whose skills and demeanor may be unique and

difficult to duplicate (Prochaska, DiClemente, Velicer, & Rossi, 1993; Strecher et al., 1994; Taylor, Houston-Miller, Killen, & DeBusk, 1990).

Tailoring Information

In addition to standardization, another important element of technology-based programs is tailoring. The emergence of computer software and "expert systems" allows for the production and dissemination of individually tailored print material (Bental, Cawsey, & Jones, 1999; Campbell, Peterkin, Abbott, & Rogers, 1997; Campbell et al., 1994; de Vries & Brug, 1999; Kreuter & Strecher, 1996; Lipkus, Lyna, & Rimer, 1999; Marcus et al., 1998; Rakowski et al., 1998; Rimer et al., 1999; Rimer & Glassman, 1998; Skinner, Siegfried, Kegler, & Strecher, 1993; Skinner, Strecher, & Hospers, 1994). This body of research has shown that tailoring increases the "self-relevance" of print material for subjects; that such material is more likely to be read, comprehended, and remembered; and that it can produce significant behavior change (Kreuter, Farrell, Olevitch, & Brennan, 2000; Strecher, 1999) across a wide variety of behavioral outcomes (e.g., smoking cessation, diet and nutrition, cancer screening). This algorithm-driven tailoring is a key element that blends the traditional mass media or even targeted media campaign with an individual-level intervention that can be delivered to large numbers of people. We can create libraries of branching content that allows for multiple situations and circumstances that can be unique and may not be taken into account in a traditional program.

Interactivity and Social Media

Computer-based programs allow for users to explore interactively and discover different outcomes or options either through interacting via different branches throughout the program or through interaction with other program users via social media.

Interactivity with different branches or scenarios is a key feature of computer games, and these elements have often been available historically through computer-based health promotion. More recently, a review of interactive games in computer-based health promotion has shown that the absorption allowed by the interaction appears to increase user attention and engagement (Baranowski, Buday, Thompson, & Baranowski, 2008). While evaluations from traditional health promotion efforts have demonstrated the critical importance of using engaging and interactive techniques to deliver their program content, the difference we underscore here may be most relevant for the younger, or "technology-native," user, who will appreciate the ability to interact with components such as video games designed to send a health promotion message online.

Another facet of interactivity is through connection with other users via social media. The advent of social media elements on the Internet has allowed users to interact with each other online through such activities as web logging or "blogging," threaded discussion groups, online chatting, instant messaging, and text messaging on the telephone. Pew Internet & American Life reports that over 70% of teens and young adults (up to age 29) engage in social media and social networking sites (Carter-Sykes, 2010). Thus, while we have relatively little data to date on the efficacy of using these social media tools for health promotion, we anticipate that the

growing popularity of devices online and on cell phones and other mobile devices such as tablet computers and the iPad™ (Apple, 2010), a mobile device bigger than a phone intended to link users to the Internet, e-mail, photos, and music, will create many opportunities for health promotion programs to rely on user-generated interaction to introduce, process, and reinforce messages about health, health behavior, and health outcomes.

Privacy

In a landmark study of audio computer-assisted self-interview (ACASI), Turner and colleagues (1998) found that more sensitive behaviors are revealed to computers than to in-person interviewers or to paper-and-pencil surveys. While this work is more specific to research on health than health promotion per se, the advantages for health promotion are evident. When asking persons to complete health promotion programs for sensitive or stigmatized issues, such as mental health, sexuality, eating disorders, and/or substance use, there may be an advantage to the privacy afforded to the individual who interacts with a computer instead of an individual or a group. In a recent qualitative assessment of youth opinions regarding the value of using computers to convey information on sexuality in Uganda, for example, participants indicated a high level of interest in the approach, stating,

> I think this program is better. It is more private; when you ask about some sensitive things, you feel shy and when these people come to school, when you have personal problems, you can not ask because you are many, you just feel shy. But when you go to this program you get to know your problem and you discuss it and you find the solution without being interrupted by any one. (Bull, Biringi, Nambembezi, Kiwanuka, & Ybarra, 2010)

Autonomy

Prior to the Internet, computer-based health promotion programs were unidirectional; that is, they were created by the care provider based on assumptions regarding patient needs in clinic settings. While these assumptions were likely to be data driven, the Internet offered users a new opportunity in autonomy by allowing them to pose questions about health and peruse multiple sites to find answers to these questions.

Individuals could seek information from multiple sources and compare and contrast information they found. Pew Internet & American Life reports that the typical health information seeker during the early days of the Internet sought information on prescription drugs, approaches for weight loss, and specific diseases (Fox & Rainie, 2000). Over time, reports have consistently shown that online health information seekers (a) want updated and current information, (b) need to trust the information source, and (c) don't typically find information on commercial sites selling products credible. Finding ways to communicate information to the widest possible audience involved ensuring that the information was readable, captured the viewer's attention, and was accurate, up-to-date, and credible. Initially, the Internet seemed to represent a perfect medium for communicating health information, and whole medical encyclopedias appeared online (ADAM, WebMD, etc).

With the advent of social networking sites and other user-driven features online (discussed in more detail in this chapter, in the section on emerging and evolving trends) users can contribute to site content through posting a web log (called blogging), participating in threaded discussions, or offering testimonials.

Portability

In the early part of the 21st century we began seeing additional technology-based health promotion opportunities arise to join computers and the Internet. The proliferation of mobile phones—extending in many cases in some developing country settings to users who had never before had a phone because the landline infrastructure was not developed—has offered additional new opportunities beyond computers and the Internet for health promotion. The critical aspects of the mobile phone that can enhance health promotion include (a) portability and accessibility and (b) increased access by disadvantaged groups.

The mobile phone has the advantage of being able to fit into a pocket or purse, and evidence is growing that phones are ubiquitous. Recent data from the Pew Internet & American Life Project show that over 60% of U.S. adults are connected through a mobile device (Horrigan, 2008).

A mobile phone is much more affordable than a computer. Web-enabled phones that can receive or send data are also more affordable than computers, although the costs of such features are often subsidized in the United States by having users sign up for user contracts that will incur stiff penalties if broken.

In 2010 we have also seen the emergence of other portable devices such as the iPad™, which allows users access to the Internet through a device with a larger screen—because this device is still relatively new, we know little about the advantages and accessibility of the product but anticipate it will offer portability and may improve access to the Internet and continue to make computing ubiquitous. The initial price of this device is $500—much more expensive than a phone, but less expensive than a laptop computer. We anticipate that many of the advantages of portability may be realized through this type of device.

As mentioned above, we face a digital divide in access to technology and, by extension, to technology-based health promotion. Much has been written about this disparity in access to the Internet and high-speed broadband or cable access among high-income and more often White populations in the United States compared to lower-income and minority groups (Bernhardt, 2000; Chang et al., 2004; Gustafson et al., 2005; Jackson et al., 2008). Even though there is evidence that the digital divide is shrinking, there is also evidence that it persists. Data on mobile phone usage have shown in multiple settings—both domestic and international—that the digital divide is substantially less for mobile phone users, and other sources show that minority users are trendsetters for phone purchase and use of minutes and data via phones (Jackson et al., 2008; Lenhart & Horrigan, 2003; Lorence, Park, & Fox, 2006).

Potentially Lower Program Costs

If the advantages of technology-based health promotion cited here are realized, we have the potential to lower program costs related to the delivery of health promotion. Specifically,

reaching larger numbers of people means lower costs per person for program delivery; standardized information delivery means fewer costs expended for training staff; tailoring information can save time in reducing exposure to superfluous information; and increasing access through ubiquitous computing may allow for fewer resources devoted to brick-and-mortar program elements. In addition, because the computer program offers additional reach, it is possible that more people could access and utilize a computer-based health promotion program than could interact with staff in traditional programs (Booth, Nowson, & Matters, 2008; Brendryen & Kraft, 2008; Bull, Gaglio, McKay, & Glasgow, 2005; Cassell, Jackson, & Cheuvront, 1998; Feil, Glasgow, Boles, & McKay, 2000; Formica, Kabbara, Clark, & McAlindon, 2004; Glasgow et al., 2007; Rainie, Horrigan, Wellman, & Boase, 2006).

WHAT ARE CHALLENGES WE FACE WITH TECHNOLOGY-BASED HEALTH PROMOTION?

While technology-based health promotion has the potential to achieve the benefits outlined here, it is important to consider the challenges we currently face in realizing this potential. Without careful consideration of these challenges and potential limitations, we may fail to identify important factors that can reduce the overall benefit and impact that our efforts in technology-based health promotion achieve. The issues considered in this section are summarized in Text Box 1.2.

Sampling and Generalizability

While technology-based work certainly does have the opportunity of reaching many more people than face-to-face programs, it is imperative that we carefully consider the methods in which we reach our audiences.

Sampling and generalizability are not issues that are unique to technology-based health promotion. However, it is important to examine some specific considerations when recruiting exclusively in a virtual environment. While the Internet offers the unprecedented reach to populations described above, appropriate sampling in this medium is challenging. Given daily additions and deletions of websites, we do not have the ability to define a sampling frame of all Internet sites, or even all sites of a particular type online. We may have better luck within a site, where we could sample users of the site—although the same challenge presents itself when users join and stop using sites. One approach to this problem from a research perspective has been employed by Harris Interactive (2010), which utilizes a panel method for sampling. This, however, is specific to research. A panel approach to sampling could be used to pretest program ideas and pilot-test program elements.

It is essential to realize that not all information discovered in online venues can be generalized to the real world, or even to the rest of the Internet. One early example involved "gift giving" and "bug chasing," the processes by which an individual intentionally infects another with HIV or seeks infection from an HIV-positive person. The *gift giver* is a term

TEXT BOX 1.2
What challenges do we face with technology-based health promotion?

Challenge	*Specific challenges technology-based programs face in this area*
Sampling and generalizability	• While it is easy to accrue large samples for programs that are delivered online, it isn't easy to select them systematically online. • Strategies such as banner advertising yield participation rates of <.01, making it impossible to generalize findings to the larger audience using the Internet.
Identification of users and confidentiality	• People may engage in deception to participate in Internet- or phone-based programs. • While confidentiality and privacy are likely more secure online than in face-to-face programs, users may distrust programs, and program planners may face challenges in establishing credibility.
Attention span and competing priorities online and with mobile devices	• Because of the volume of information that technology users must process, multitasking has become commonplace. Evidence shows that multitasking is on the increase (Carrier, Cheever, Rosen, Benitez, & Chang, 2009) but also that it actually reduces the ability to absorb or comprehend material. • The growing volume of information and activities available online means health promoters must compete for participant attention with often better-financed games, videos, and so on online.
Bias and ongoing digital divide	• Evidence remains that persons with less income have less access to the Internet and use it less often, suggesting programs relying on the Internet to deliver content will be biased. • While Internet users tend to be more affluent, lower-income communities are among the fastest-growing consumers of mobile phone technology.
Technological obsolescence	• Technology-based health promotion that relies on lengthy development and evaluation periods may find some or all elements of the program obsolete by the time it is implemented and evaluated.

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given to someone infected with HIV who makes it known that he or she is willing to infect another individual. The *bug chaser* is the name given to the individual intentionally seeking an HIV-infected partner for sex to increase his or her own chances of infection. This is a behavior that can occur in non-Internet venues, but one can easily imagine that the Internet can

magnify the potential for partnerships to form and infection to be spread rapidly. As a research topic, this attracted some attention and concern, and even some media activity; however, in general, the phenomenon of bug chasing and gift giving has not been shown to be widespread (Grov & Parsons, 2006). Many countercultural websites are fascinating and bizarre (examples such as proanorexia websites, violence-oriented sites, and sites promoting self-destructive activities abound); however, users of these sites are either very few or nonexistent, and the online phenomenon does not always translate to real-life behavior. Thus, observing the web to learn about health promotion activities can be misleading, which implies that we must exercise caution in generalizing from observational studies to the population as a whole.

While observational studies clearly have their place, they should be substantiated by further research that indicates the size, scope, and impact of the issue being studied.

Another concern with generalizability arises with the use of banner advertising for recruitment, be it for surveillance or program activities. Our own experience, for example, shows that persons clicking on banner advertisements represent only .01% of those exposed to the banner, and those who continue the program after clicking on the ad are only a fraction of those clicking (Bull, Vallejos, & Ortiz, 2008). Such low "click through" rates, as they are named, illustrate the impossibility of generalizing any program findings to a larger audience. We will cover specific strategies for sampling and recruitment to address these challenges in Chapter 4.

These sampling concerns are related to the concern of validity. If we cannot generalize our findings based on representative samples, how valid will our programs be, particularly across diverse technology users? We submit that the issue of validity for technology-based programs isn't unique to technology per se: Rather, it remains one of concern for any health promotion program. We advocate attention to validity for programs whether they are technology based or based in other settings. What technology-based programs do afford that other programs may not is a platform to more easily test our validity across groups because of the ease inherent in contacting and interacting with groups that technology affords. Therefore, processes of development and testing programs can include plans for adaptation and validity testing for diverse technology-based audiences.

Identification of Users and Confidentiality

When recruiting for any technology-based program using virtual approaches, the identification of users and participant privacy can be a challenge. Similarly, when delivering program content using technology, it isn't always possible to know if the person you intend to expose to your content is the person who receives and views it. This issue is only exacerbated in Internet and mobile phone programs when enrollment and program activities are divorced from direct face-to-face staff contact. Persons enrolling on the Internet may lie about program eligibility criteria, and they may attempt to enroll multiple times (especially if there is an incentive). Persons using mobile phones may not be the exclusive users of a phone, or their phone could be used or answered by a friend or family member. Many of the problems inherent with self-reported data are exacerbated by the Internet. While anonymity and accessibility can provide an environment of honest and

open communication, it can also allow respondents to falsify data, misunderstand questions, or otherwise provide inaccurate responses. Online survey data can be maliciously or accidentally falsified, and there is no in-person support if respondents have questions or concerns. Privacy concerns online are paramount, and no one wants to report sensitive behaviors to a system that can be "hacked" by online vandals. Similarly, it is difficult to imagine reporting illegal behaviors to a government behavioral surveillance system. This is a factor in in-person interviewing as well, but an in-person interviewer has the opportunity to answer questions and address concerns from the respondent. Online, the respondent must trust that the person on the other end of the survey is beneficent and intends to keep the data confidential. We will further discuss issues of user identification and verification in Chapter 4, and of user privacy in Chapter 2.

Attention Span and Competing for Attention Online and With Mobile Devices

Attention spans are an increasing concern with technology-based health promotion. Surveys are often long and occasionally tedious, and Internet and mobile phone users are accustomed to brief interactions; thus, a long survey may appear even longer when conducted using technology. When in a face-to-face interview, the respondent and the interviewer may develop a rapport that allows the survey to feel more like a friendly interaction. Using technology, however, the sterile nature of the site may contribute to boredom, wandering attention, and high dropout or noncompletion rates.

An additional concern is the competition for attention in the virtual world. New websites are regularly added to the Internet, and there is an ever increasing volume of data transmitted via e-mail as well. This suggests that we have challenges in creating and disseminating content for health promotion using technology that will effectively compete with the other content that is constantly being sent to technology users. We will have to strategize about how to gain and hold participant attention in an environment that is increasingly crowded, likely with content that is more appealing, entertaining, and personally relevant for users.

Bias and Ongoing Digital Divide

There is an inherent bias in technology-based health promotion, because such programs are only available to people who have access to the appropriate technology. In some populations of interest, this strikes a major blow to the ability to generalize the survey results to the larger population. It is a well-established fact that health issues of persons with low socioeconomic status are very different from those of wealthier, educated, employed, insured citizens. The likelihood of owning a computer or mobile device with Internet access may be similarly related to socioeconomic status. Thus, surveying health problems via Internet questionnaires may result in a biased sample of mostly wealthy, educated persons and an inaccurate portrayal of the health conditions of the poor. As mentioned above, however, mobile phones may someday fill this "digital divide" by ensuring access for people who lack the means to purchase a full computer system. At present, a desktop or laptop computer with reasonably fast Internet access costs, at a

minimum, several hundred dollars. A mobile phone, on the other hand, costs far less and may provide many of the same communication and information features found on laptops. Thus, online behavioral surveillance and other Internet-based health promotion efforts will likely need to be adapted to the more compact, mobile medium.

There is evidence that information offered on the web about health is frequently delivered at a very high level of literacy—that is, greater than a ninth-grade reading level (Bull, Leeman-Castillo, Ortiz, & Gutierrez-Raghunath, 2008). With ample evidence that persons with lower literacy skills and limited English proficiency also suffer disproportionately from negative health outcomes, it is imperative that we do more to ameliorate this situation.

The fact that technologies haven't been widely used for health promotion with less literate, less educated, or non-English-speaking groups is ironic, given the potential for technology to overcome these challenges with audio, video, cartoons, and other interactive but more accessible content. There are some exceptions to this finding to date, however; research is currently being done with Latinos in the Denver metropolitan area to use computer algorithms to offer feedback on physical activity, nutrition, and smoking in an effort to promote healthy behaviors (Bull, et al., 2008).

Data have consistently shown lags in access to and use of technology among poor people, minorities (inasmuch as these groups are overrepresented among the poor), and elderly (King et al., in press). While new assessments of this digital divide show that these lags are diminishing, they do remain. It is important that health promoters recognize the existence of the digital divide and try to assess how large it actually is for the population they wish to engage with technology-based health promotion. Failure to do so can bias samples to overrepresent higher-income and better-resourced groups, and limit generalizability of findings to those groups that may not have as great a need for intervention. Program planners need to consider whether they want to conduct technology-based health promotion because it is the most appropriate modality to use, or because it is convenient and easy for them.

Even when barriers to access and literacy have been addressed, there may be cultural considerations to conducting technology-based health promotion with specific groups. In preparation for a pilot study of a computer kiosk to promote heart-healthy behaviors for Latinos, researchers learned that there were assumptions within the Latino populations they hoped to reach that use of the Internet and computers was anathema to many within their community, and, recognizing that, they made substantial effort to create a program that was culturally relevant and engaging for Latinos specifically (Padilla et al., 2010). More on making programs culturally relevant is discussed in Chapter 3 in the section on best practices in technology-based program development.

Technological Obsolescence

One of the biggest hurdles in technology-based health promotion is obsolescence. Health promotion program planning, implementation, and evaluation have accepted standards of rigor. With rapid evolution of technology, however, we may no longer have the luxury of time to be able to investigate if a technology-based innovation works. If we take several years to

design programs, make them culturally appropriate for the audience, accrue samples, and follow them for long periods of time, we may show efficacy for an innovation that is obsolete. One example of our own learning in this area was for an intervention to promote HIV prevention among youth, using primarily static design elements with some tailored feedback, but no interactivity between users. By the time 4 years had passed between obtaining research funding and completing the randomized trial testing the efficacy of our online intervention, the era of social media was upon us with its attendant blogs, threaded discussion, and user-generated commentary, making our own intervention potentially obsolete (Bull, Pratte, Whitesell, Rietmeijer, & McFarlane, 2009).

While evaluation of health promotion efforts is known for attention to detail and rigorous methodologies, the rapid evolution of the Internet and other technologies is proving to set up a tension that has important implications for our work. We need to keep pace with the rapid evolution in technology with similar agility in our research methods. As researchers began to document patterns of web usage and behaviors and to test out the efficacy of providing information online, using algorithms to give feedback and communicating in a bidirectional manner using e-mail, the Internet world was moving into a new era altogether—the so-called "Web 2.0" world of social media and social networking. This is an era that moves beyond uni- and bidirectional communication into a much stronger emphasis on social networking and an explosion of information sharing.

Should we relax our standards, then, to allow for more rapid assessment and evaluation? It may not be necessary to do so. We do need to investigate approaches that can prepare us to rapidly implement our research so that findings are relevant. In Chapter 2 of this book, researchers and program planners can learn strategies for priming their institutional review boards (IRBs), and other internal ethics committees so that when technology-based research and program evaluation opportunities arise they can knowledgably review protocols and quickly approve them. In Chapters 3 through 5, we touch on issues that will allow health promoters to increase their capacity to collect, manage, and analyze high-quality data quickly, both on computers and on mobile phones. In Chapter 8, we go into more detail on the promise of social media and social networking sites and how we might capitalize on them for health promotion. In each chapter we identify new horizons for technology-based health promotion—that is, what we foresee in the coming years that we can prepare to utilize to our advantage for remaining leaders in the assessment of development, testing, and translating technology-based health promotion to reach the highest audience for the greatest impact.

In general, the Internet and mobile phones have become well integrated into the fabric of modern life. However, interventions on health behaviors seemingly have not kept pace with this fast-moving technology. It seems that as soon as we learn to use and evaluate the use of current technology, it is already outdated. As we write this, new innovations in ubiquitous computing are in development. Technologies will allow users to monitor their own biological outcomes, such as sugar levels for diabetics or biobehavioral cues (galvanic skin response, increased heart rate) for addicts who begin to experience withdrawal or craving symptoms. When the monitors detect a problem, they can send a digital signal to a remote counselor or health provider, and the user can receive a phone call or text message offering support or assistance. This level of tailored health intervention is within reach, but we do not yet grasp its full potential.

THE ROLE OF THEORY IN TECHNOLOGY-BASED HEALTH PROMOTION

The discussion above outlining both promises and limitations of technology-based health promotion offers information about elements that can be critical for inclusion in a conceptual framework hypothesizing processes through which technology-based health promotion operates.

Reviews of technology-based health promotion reveal that there has not been systematic attention to the role of theory in technology-based interventions. The types of interventions that have been employed remain largely focused on offering individuals opportunities to make behavior changes. These interventions have the opportunity to employ well-known individual-level theoretical perspectives related to behavior change such as the health belief model (Rosenstock, 1974) and the theory of planned behavior (Azjen, 1991). In addition, they offer options for including an understanding of how individuals interact with others whom they consider important, through application of social cognitive theory (Bandura, 1986) and diffusion of innovations (Rogers, 1995). Indeed, there is evidence from nontechnology interventions that when these theoretical perspectives are appropriately applied to interventions, they contribute substantially to intervention content and are considered invaluable for promotion of healthy behaviors (Albarracin, Fishbein, Johnson, & Muellerleile, 2001; Albarracin et al., 2005).

We know of at least two technology-based interventions shown in the Appendix that paid explicit attention to applications of individual-level health behavior change theories, and these are two interventions with positive results, the D-Net trial and the LUCHAR (Latinos Using Cardio Health Action to Reduce Risk) pilot study (Bull et al., 2008; Glasgow, Boles, McKay, Feil, & Barrera , 2003).

Within the broader field of public health, there certainly has been attention to theories of social interaction, culture, and environment and their varied influence on health. For example, researchers have explored the relationship between social stigma and health (Benzies & Allen, 2001; Centers for Disease Control and Prevention, 2000; Crooks, 2001; Fortenberry et al., 2002), the role of culture in health (Caldwell, Caldwell, Caldwell, & Pieris, 1998; Chin, 2000; Duffy, 2005; Fisher & Ball, 2002), the influence of social networks on health outcomes (Christakis & Fowler, 2007), and the concept of structural violence that perpetuates limitations in access to care and suggestions of individual responsibility for health outcomes even in the face of marginalization, poverty, and environmental degradation (Farmer, 1999; Farmer, Connors, & Simmons, 1996). However, we do not regularly see these theories explicitly applied to health interventions in general, and they have not been applied to technology-based health promotion in particular. As technology-based health promotion has evolved, the integration of relevant theories into programs that can offer conceptual frameworks to guide program development and explain program success or limitation has been notably lacking.

As mentioned above, we know from extensive research in health promotion that interventions at the individual level focused on specific concepts that precede behavior change have been shown to be effective (Albarracin et al., 2005; Courneya, Estabrooks, & Nigg, 1997; Courneya, Nigg, & Estabrooks, 1998; Wallace, Buckworth, Kirby, & Sherman, 2000).

This constellation of constructs includes such things as behavioral beliefs and decisional balance, or the idea that performing a behavior will offer more benefits than drawbacks when compared to not performing a behavior. Norms, or the beliefs about what important others do and think, also influence behavior—it is important to think that a group of peers would approve of a behavior, for example (Azjen, 1985). Self-efficacy, or the belief that one can perform a challenging behavior, even under difficult circumstances, is also important (Bandura, 1986). Finally, forming specific intentions to perform a behavior increases the likelihood of doing so (Azjen, 1985).

All of these individual-level constructs can be impacted through exposure to technology-based programs. Several that are described in detail later in the book have utilized these concepts in their program design (see Chapters 6–8 for case studies).

As will be discussed in greater detail below, one element of technology that recently emerged that has already impacted the landscape of technology in general and technology-based health promotion in particular is that of social networking online, also called Web 2.0. Web 2.0 allows users to interact not only with a machine but also with other computer users via the Internet. The proliferation of Web 2.0 features such as threaded discussions and posting opinions via web logs (called blogs) has opened up substantial interest in the role of social networks in health and health promotion. Researchers have recently demonstrated the importance that social networks in real life have for such important health issues as obesity and smoking (Christakis & Fowler, 2007).

Of particular interest, therefore, within technology-based health promotion, is the theoretical perspective of social networks, both real world and virtual. What is possible to study, but is essentially an unexplored area, is the influence that virtual social networks have on health outcomes and how they can be harnessed in health promotion efforts.

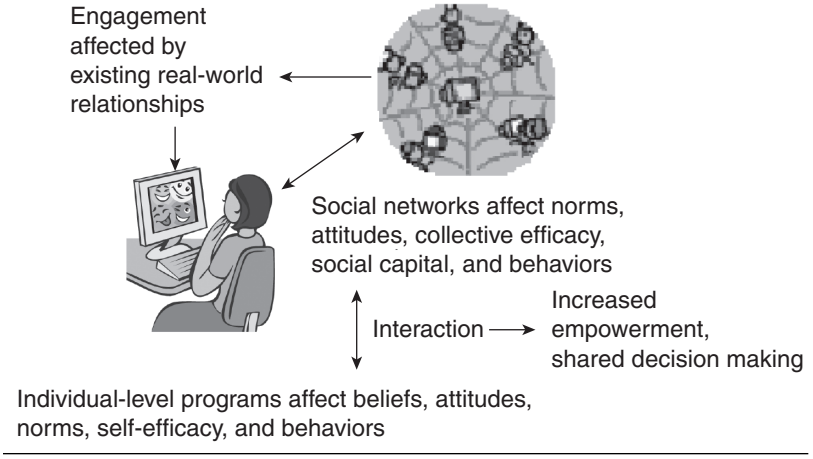
In addition to social networks, the theoretical perspective of social support may be particularly helpful to consider in the Web 2.0 era (Beal, Ausiello, J., & Perrin, 2001; Boutin-Foster, 2005). Investigators can take the opportunity to consider how having social support via social networking sites can enhance or detract from health outcomes. They can explore how user-generated content may increase ownership or identification with health concerns or responses to health concerns.

Given the potential critical importance that reach will have for increasing the impact of technology-based health promotion, we also have a need to make explicit theory-based approaches for increasing and facilitating exposure to and engagement with technology-based health promotion by users.

Finally, technology-based research allows for consideration of completely new theoretical ideas. For example, what is different about the interaction with technology that occurs simultaneously with human interaction? How does the technology mediate or moderate effects of an intervention that includes social networks and social support? We have unprecedented opportunity to intervene in social networks online, and to research networks and technology use among mobile phone users. What new theoretical contributions about the interaction between people moderated by machines will emerge?

Figure 1.1 offers one depiction of how all of these theoretical perspectives come together for technology-based work. Individual-level concepts such as beliefs, norms, and self-efficacy are

Figure 1.1 Theoretical elements to consider in technology-based health promotion



depicted below the picture of a computer user. The user has the potential to interact with others in a real or virtual social network, as depicted in the center of the figure. It is of importance to consider the role that persons within these networks may play in helping individuals get exposed to online materials, and whether exposure to technology-based health promotion is indeed mediated by others within networks. In addition, concepts such as collective efficacy and consciousness raising within networks and the social capital of groups as they interact with technology are also areas for study.

WHAT ARE THE CURRENT AND BEST PRACTICES IN TECHNOLOGY-BASED HEALTH PROMOTION?

Hybrid Programs—Using Technology to Enhance or Supplement Health Promotion

Observational Studies Using Technology

Health promoters have been using computers, the Internet, and mobile phones to test and refine approaches for health promotion for several decades. The Appendix (p. 235) offers descriptions of selected health promotion efforts that are technology based. This Appendix is intended to be illustrative of key uses for these modalities that are instructive. Given the rapid evolution of the field, we do not anticipate that this table will be exhaustive; rather, we hope that it can serve as a resource to illustrate approaches that represent the types of technology-based health promotion described here.

Observational studies related to health that have been done using technology illustrate the utility of taking the time to understand the environment in which you plan to implement your project. By doing observational work you can better understand the ways that users interact with the technology of interest and how they engage with others using the technology. You can use observational data to design and structure your program and to consider the extent to which the information gleaned can be generalized to the population at large. We will cover processes for observational studies and other formative program development for technology-based health promotion in more detail in Chapter 3.

In one early, observational study (Bull & McFarlane, 2000), we conducted a restricted form of participant observation in multiple online venues that existed for the purpose of facilitating sexual contact between users. We observed individuals seeking sexual contact, finding potential partners in chat rooms, and moving to "private" chat or other, nonpublic communication venues. We looked for information that might indicate that online sex-seeking is common, that the sex facilitated is anonymous and unprotected by condoms, and that seeking sex online could increase a person's risk for sexually transmitted infections (including HIV, the virus that causes AIDS). This observational study was a key element in program development, allowing us to better understand how and when people used the Internet—these data could then be used for more effective program development to intervene and address sexual risk behavior online.

The main purpose of an observational study such as the one described above is discovery, leading to formative work in preparation for a health promotion program. In this example, the researchers tried to understand the process by which users engage in online activity. Components of online activity that interest health promoters include health-seeking behaviors as well as risk-seeking behaviors. How do users look for information? What type of format is especially appealing? What makes some information credible and other information blatantly untrustworthy? What attracts people online? What makes them think and feel and learn in ways that will enhance their personal and public health? Watching the way users interact with information, with online experts, and with other users is an excellent method of discovering new directions for health promotion activities.

Technology-based health promotion is not limited to health promotion for the individual. Technology can be used at the observational level to determine how well providers or organizations are meeting standards for health promotion and care delivery. In an observational study, we reviewed and coded features of 87 publicly available diabetes websites hosted by governmental, health plan, commercial, pharmaceutical, and not-for-profit organizations. We assessed whether each website was using online opportunities in the areas of interactivity, theory-based interventions, social support, and evidence-based care. The majority of sites provided information, essentially using an electronic newspaper or pamphlet format. Few sites offered interactive assessments, social support, or problem-solving assistance, although there were some significant differences in these characteristics across the types of site. The authors concluded that current diabetes websites fall short of their potential to help consumers, and made specific suggestions for ways to improve the helpfulness and interactivity of these resources (Bull et al., 2005).

Technology to Facilitate Surveillance

Surveillance work offers an opportunity to assess the scope of a health promotion issue. For example, we may learn in observational studies that thousands of users read websites about hypnosis for smoking cessation. But how many people actually undergo hypnosis and quit smoking? People most likely read about a wide variety of treatments for whatever condition they may be experiencing, and they gather information from other (offline) sources as well. To understand the full range of health-seeking behaviors, it is useful to conduct surveillance surveys. The aim of these surveys is to comprehensively study a set of health behaviors or conditions in a quantitative, structured way. For health promoters, the appeal of a technology-based survey—whether it is delivered at a computer kiosk, online, or through a mobile device—is obvious: The automated, user-entered data process streamlines data collection and eliminates the need for cumbersome paper-and-pencil surveys and time-consuming data entry. If entered data are illogical or out of range, the survey software can prompt respondents to check their answers for accuracy. Technology-based surveys can be completed in a fairly short time frame and can circumvent the need to train interviewers. Additionally, survey respondents can be presented with different versions of the survey, depending on their answers to previous questions. This type of survey is called an adaptive questionnaire, because later questions are adapted to accommodate information provided in earlier questions.

Those using the Internet for surveys have the added advantage of being able to reach many more respondents in a very short time. Further benefits of Internet-based surveillance surveys include the ability to surmount the twin obstacles of geography and population mobility. For example, in a study of survivors of childhood cancer (Cantrell & Lupinacci, 2008), participants were geographically scattered and represented a relatively small proportion of the population. Using the Internet, the challenges of finding cancer survivors among the general population could be reduced, although in this particular study, the authors were unsuccessful in recruiting a large number of participants. Similarly, populations of diabetics, people living with HIV, or people with cancer, alcoholism, or mental illness can be found online and offered the opportunity to participate in a survey.

Ultimately, survey data collected using technology can inform program development, which will be discussed in more detail in Chapter 3; it can also be used to assess program effects, which will be discussed in more detail in Chapter 5.

Examples from the review shown in the Appendix illustrate how behavioral surveillance online can facilitate understanding of the scope of a public health concern and opportunities for health promotion intervention. In the study on behavioral risk factors among men who have sex with men (MSM) in China, Zhang, Bi, Hiller, and Lv (2008) showed that collecting data from MSM online versus collecting data from community venues resulted in different behavioral risk profiles. For example, MSM online reported fewer female partners and were more likely to identify as homosexual compared to MSM in community venues. The authors of this study concluded that online interventions for HIV prevention in this group could more readily focus on topics of homosexuality and could concentrate on promotion of condom use with male partners.

Also in China, Sun et al. (2007) used an online behavioral surveillance system to understand the spread of health behaviors in remote areas as well as in densely populated urban centers. The Chinese behavioral surveillance system for HIV-related behaviors, piloted in 2004, involves drug users, female sex workers, men who have sex with men, STD clinic clients, long-distance truckers, and students. Because China is a vast nation with a low HIV prevalence and many remote areas, behavioral surveillance can be of great use in predicting the future directions of HIV incidence.

An online behavioral surveillance of problem drinkers (Lieberman & Huang, 2008) illustrated that over 1,000 users of an alcohol evaluation website were less likely to recognize their drinking as problematic compared to persons seeking treatment face-to-face. In addition, users in the online sample were less likely to take steps to change their drinking behaviors, although they shared a similar level of concern about the effects of their drinking when compared to those seeking treatment. This work illustrates the opportunity to develop online interventions for problem drinking that may be more focused on recognition of pathology and skills building for change.

Technology Used to Enhance or Extend Health Promotion Efforts

There is growing interest in the use of technologies to extend or enhance health promotion efforts that happen in clinics or schools or other settings. Consider, for example, the simple approach to enhance care delivery offered when persons can communicate via e-mail with a nutritionist. This approach was one of the early efforts shown to have efficacy for weight loss (Tate, Wing, & Winett, 2001). Persons enrolled in a nutrition education program could send messages and communicate via e-mail with a counselor at regular intervals. They could also engage in "ask the expert" opportunities to post questions and have them responded to via e-mail or in a more public forum (such as a threaded discussion board). There are relatively few published studies examining the use of technology to extend clinical services, and this could be a ripe area for program development (Glasgow, Bull, Piette, & Steiner, 2004; Marrero et al., 1995; Prochaska, Zabinski, Calfas, Sallis, & Patrick, 2000). In addition, it is critical that we consider the potential for technology to be utilized for multilevel interventions. There has consistently been a call to address health behaviors not only at the individual level but also at the social, organizational, and environmental levels (Friedman et al., 2007; Piot, Bartos, Larson, Zewdie, & Mane, 2008; Rice, Stein, & Milburn, 2008; Sanders, Lim, & Sohn, 2008; Taylor, 2007). We anticipate that intervening through a care provider using technology could be promising—consider, for example, offering care providers detailed tailored information about patient behaviors through shared electronic records. When a patient inputs his or her daily blood pressure or glucose measures and uploads these to a shared file, the physician could be prompted to make care more tailored and appropriate for him or her (Siek, Khan, & Ross, 2009). Another provider-level intervention that could enhance care and potentially behavioral outcomes is one that could deliver updates in guidelines for care to a provider's mobile device.

Technologies could be used beyond the individual to facilitate behavioral change within families—for example, programs already exist to address childhood obesity through parental education. Low-income parents can attend cooking classes and nutrition education workshops that help them identify strategies for more nutritious shopping and cooking (Swindle, Baker, & Auld, 2007). Technology can be utilized to reinforce and enhance such programs; for example, parents could receive recipes or information on days/times for a farmers' market all via text message.

Stand-Alone Interventions for Infectious and Chronic Illness Prevention

As mentioned above, in the pre-Internet era, health promotion experts looked for effective ways to incorporate health messages into the flow of everyday life, reaching people via radio, television, motion pictures, print media, billboards, and community awareness campaigns. Beginning in the 1970s, they also began to deliver health promotion programs via computer. As the computer and Internet became a mainstream tool, a natural early step involved adapting print, and later audio and video materials, to these technologies. Online, billboards were translated to banner ads, and brochures became webpages. Although these communications were intended to raise awareness, they were limited in the sense that there was only one direction to the message: from the experts to the masses. It rapidly became obvious that providing messages to the public, though necessary, was in no way sufficient for changing the behavior of the public in regard to health. Furthermore, unidirectional messages failed to capitalize on the interactivity and multidirectional communications offered by technology.

Interventions aimed at changing health behavior and related outcomes using technology have been attempted in fields as wide-ranging as mental health (depression and anxiety; Spek et al., 2007), physical activity and exercise (van den Berg, Schoones, & Vliet Vlieland, 2007), weight loss (Weinstein, 2006), diabetes (Kim & Kim, 2008), and smoking cessation (Rodgers et al., 2005). The Appendix (p. 235) describes a number of studies in which researchers have intervened upon various behaviors in an attempt to increase the health of the target groups.

In general, the goal of such interventions is to change the way people behave such that their health improves. Thus, we might try to keep people from smoking, overeating, or engaging in unprotected sex. We might discuss food safety, sunscreen, and physical activity. By engaging in multidirectional discussions, we may provide social support or even therapy using technology.

There are numerous examples of best practices in technology-based intervention for health promotion. In a review of weight-loss programs delivered online, Weinstein (2006) considers the potential impact of Internet programs introduced above. Even if they produce smaller changes in behavior than their offline counterparts, Internet programs have the potential for huge impact simply due to the number of people that can be reached for low cost. Internet interventions, she suggests, should take into account the sociocultural background, literacy, and individual needs of the target audience. But it is exactly these contextual, background variables that are difficult to assess online. Thus, Internet interventions with face-to-face components were posited as having the most potential for success. Mixing the media and modalities becomes more and more important as the Internet becomes more portable, accessible, and ubiquitous.

A very promising example of a combined Internet and mobile phone intervention for persons with diabetes was studied by Kim, Yoo, & Shim (2005). Patients in the intervention (Internet/cell phone) group were significantly able to maintain better control of their baseline hemoglobin.

Although this study only included 51 patients, it does show promise for the type of program that could combine clinic-based and technology-based health promotion.

WHAT ARE EMERGING AND EVOLVING TRENDS IN TECHNOLOGY-BASED HEALTH PROMOTION?

Web 1.0 and Web 2.0 and Social Networking

Early in the Internet era, the primary use of the medium was for sharing information, and this involved primarily moving text-based documents from paper to electronic format and placing them online. The Internet was seen as a mechanism to access information.

As the Internet began to grow in popularity, programmers also realized that in addition to simple text-based information, they could also use algorithms to make information personally relevant for people. Thus, the Internet began to shift from simply a mechanism for unidirectional presentation of information to a more interactive environment. People could give the computer information and receive something specific and tailored in return. With the use of pre-programmed algorithms, programs on the Internet could give people specific feedback. For example, in the field of health, if you typed in your height and weight, a program could calculate your body mass index (BMI); your age and gender would yield information on risk for various diseases. These interactive features could be in the form of quizzes, games, or surveys.

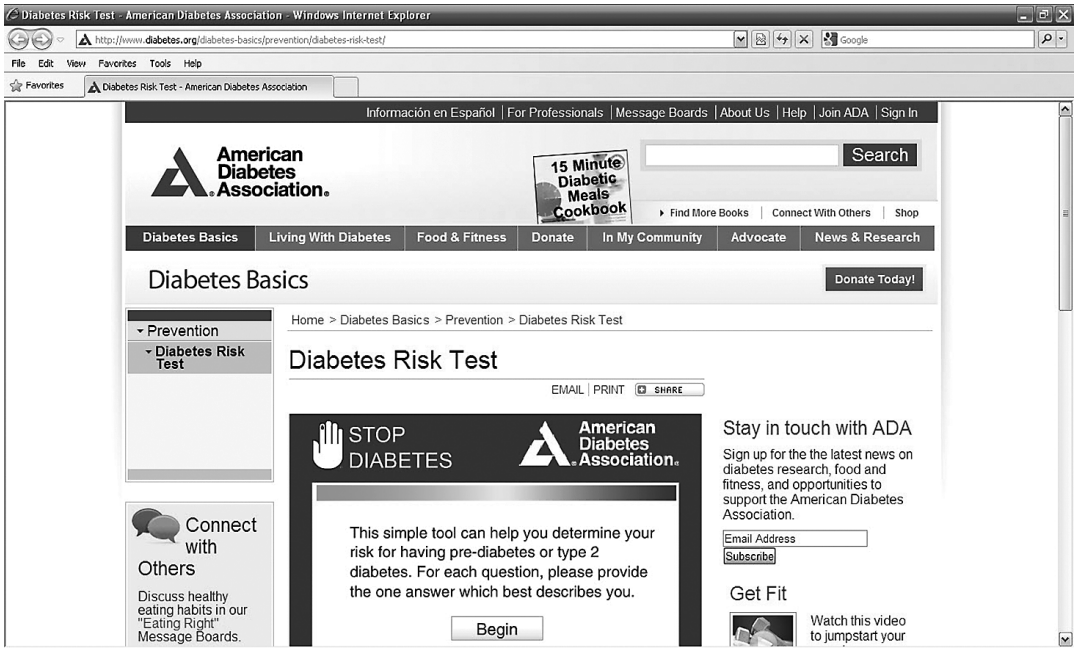
In addition to obtaining information and getting feedback based on algorithms, early research initiatives for health considered the efficacy of using e-mail communication as an intervention strategy. This activity begins to move research on the Internet from increasing information access and interactivity with the machine to interactivity with people—albeit limited to bidirectional interactivity, this human interactivity is a hallmark of the Web 2.0 era that we are in today—and is described below.

The other activity that began in this early period was participation in what were called chat rooms and then bulletin boards—electronic equivalents of the corkboard where people could post information and ask for replies. These are two initial examples of Web 2.0, which ushered in a shift to much more interactive multidirectional communication online.

Figure 1.2 shows a screenshot with an example of the text-based information and algorithms that characterize these early online offerings. This time period online has been dubbed "Web 1.0."

During this time, researchers began to consider both how people used the Internet in ways that might put their health at risk and how they might use the Internet to promote health. The primary attraction of the Internet for research was the ability to instantly reach very large numbers of people. Data collection that previously would take months or years could now be accomplished within weeks or even days.

Figure 1.2 Example of a Web 1.0 site



Consider the sample sizes shown in the Appendix. Larger sample sizes also allowed researchers to make better statistical inferences about their findings, and added to the excitement about using the Internet for research. Larger sample sizes alone, however, cannot be the basis for drawing conclusions on inferences from data, and these are specific considerations we will address in Chapter 5.

Web 2.0 is characterized by this multidirectionality. Sites such as MySpace, Facebook, LinkedIn, and others have features that allow people to (a) web log (or blog)—that is, offer online journals on any topic; (b) have threaded discussions or chat sessions; (c) allow people to share testimonials; and (d) in general have "user-driven" content. This user-driven content is characterized by a much more democratic process in placing and posting content. Users will establish policies and self-monitor, but in general there is much greater opportunity for users to give feedback to website designers regarding design and content preferences, and users also want the opportunity to share with each other, cocreating a site and networks of users.

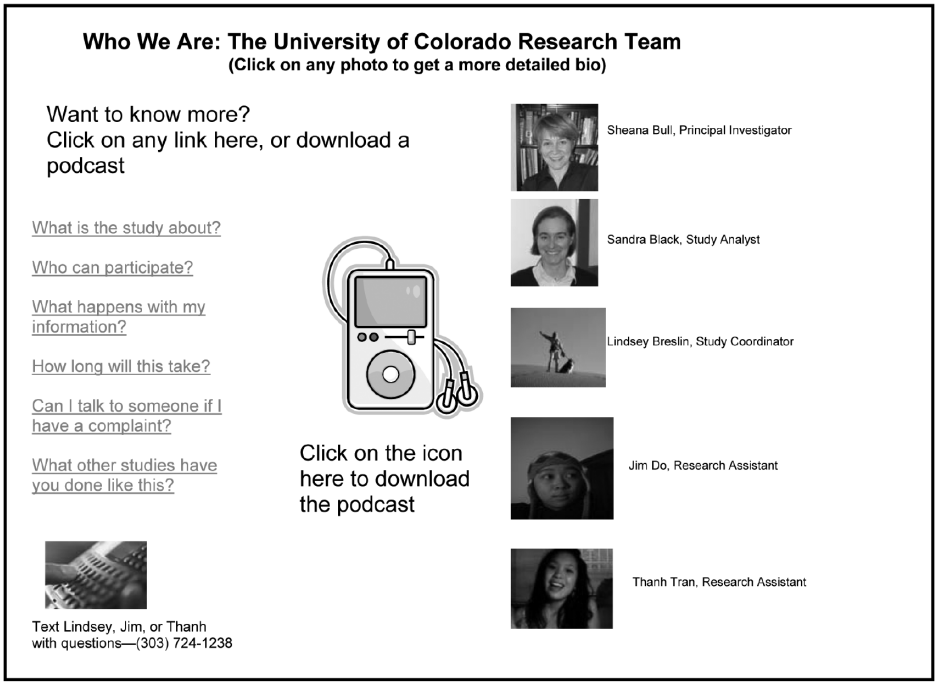
Two of the more famous social networking sites are Facebook and MySpace. Pages on these sites have infinite options for self-expression and can allow the user to post photos, music, video, art, and so on. Social networking sites also allow people to use the sites to promote their product—indeed, MySpace began as a way to promote information about bands. MySpace has been used by bands, politicians, businesses, and other groups and organizations to get information out and share it with others in the MySpace networks. Sharing information

becomes easier, since people will list their "friends" (usually people they are close to who also have a page on a given social networking site), and they can easily forward content from one page to the many "friends" they have in their network on that site.

Researchers have begun to utilize MySpace and Facebook in their work. As we will elaborate on further in both Chapters 2 and 8, there is a growing expectation for transparency in evaluations of technology-based health promotion. People can use the Internet to share detailed information, not only in text form but also in digital photos and video. Evaluators of health promotion using technology can consider using social networking sites to create their own profile that they can then post to offer such information about themselves for potential participants. It can lend a sense of credibility to the evaluation endeavor, and also assist in recruitment and retention of participants. Figure 1.3 shows an example of a Facebook page used to explain a program evaluation on that site.

As the Internet continues to evolve, there will likely be a Web 3.0, which, according to early conjecture, may involve access to and transfer of large amounts of data, moving more definitively into a paperless society. There is growing use of what has been termed "cloud computing" (Rosenthal et al., 2010) whereby one can access servers for a limited period essentially renting bandwidth and computational time to run and transfer data. This may be relevant for technology-based health promotion evaluation efforts that seek to gather and analyze large amounts of data simultaneously at lower cost.

Figure 1.3 Explaining program evaluation on a Facebook page



Portability

It is clear that there is increased attention to access to the Internet via mobile phones, and now through other portable devices such as the iPad™, suggesting there will be an emphasis on universal and ubiquitous access to data and information. Ultimately, health promoters will have to consider approaches for conducting their work in this new environment. The emphasis on instant access to information and data suggests we should seek approaches to adapt our methods for rapid implementation of program evaluation, quickly gathering, managing, and analyzing data so that findings can be relevant for the present. Failure to do so may mean our well-controlled and rigorous studies will offer detailed findings on technologies and innovations that are obsolete.

SUMMARY

The use of technology for research in health has proliferated in a decade, and there is promise and potential for continued use of tools such as computers, the Internet, and mobile phones and other portable devices to collect, manage, and analyze data. We can use these technologies (a) to conduct observational studies—for example, to document how, when, and where people engage with a particular modality; (b) to conduct surveillance—to document knowledge, attitudes, and behaviors that are critical for epidemiologic assessment; and (c) to intervene and attempt novel and engaging approaches to improve health outcomes.

We face both opportunities and limitations for health promotion using technologies. Within the field of health promotion, we have tremendous opportunity to use technology to increase the reach of our services and research to the multitudes of people who are connected to computers, the Internet, and mobile phone technologies. In order to capitalize on these opportunities, however, we need to think about smart ways to recruit and engage participants in environments that are increasingly crowded with others vying for users' attention. Expanding the study of social and behavioral science theory to consider ways to capture and maintain attention and subsequently engage individuals in technology-based interventions is a priority. Finding approaches to ensure that we can increase access to technologies is also critical. At the same time, using technologies that diverse populations have already embraced is likely to yield results that are more relevant. We have yet to capitalize on opportunities to go substantially beyond individual-level interventions with technology to integrate technology into institutions to facilitate service delivery; we have yet to see strong examples of health promotion programs that target providers of care or seek institutional, organizational, or societal change rather than individual-level behavior change. Finally, we have a critical need to stay ahead of the curve in technology-oriented research for health. Using traditional time frames for conducting evaluations may only result in findings that are obsolescent by the time they are released. Development of timely, rigorous, and rapid assessment procedures for technology-based program evaluation efforts is of the highest priority.

Emerging trends suggest we have moved from using technology to tailor content and make it attractive to including social networking and ubiquitous computing in our technologies. In the past decade with the proliferation of Internet and mobile phone use, we have also seen a substantial change in the ways that people use technologies, moving from graphic intensive and interactive computer programs to social networking endeavors, where user-driven and -created

content is the norm. We are on the cusp of explorations of social networking sites and activities on the Internet and through mobile phones, and this is a promising area for research.

? CONCLUDING QUESTIONS

1. How could traditional research that you are familiar with be improved by using technology-based adaptations and methods for delivering content?
   a. Name three specific benefits you could anticipate from delivering health promotion content using technology.
2. What are some specific drawbacks of using technology to deliver program content for health promotion? Consider a health promotion program you are familiar with in formulating your answer.
3. What new contributions would this work offer in terms of better understanding the theoretical interface between interaction with computers and program content and anticipated behavior change?
4. Identify an example from the literature of at least two health promotion programs that show efficacy in promoting behavior change. Describe the program, what technology was used, and how technology was employed to implement the program.

CHAPTER EXERCISE

Justify the technological adaptation of materials from an existing health promotion program.

1. Consider the Diabetes Prevention Program (DPP). DPP was evaluated in a large research study. The goals of the study were to understand if people with prediabetes could prevent onset of type II diabetes through changes in nutrition and physical activity. The DPP behavioral lifestyle intervention was indeed found to be effective. Detailed findings from this research can be found in the February 7, 2002, issue of the *New England Journal of Medicine.*
2. Review some of the written materials developed for the DPP program at this website: http://www.bsc.gwu.edu/dpp/lifestyle/dpp_part.html.
3. Your task is to do the following:
   a. Write a justification for why an adaptation of program materials is needed and will likely be beneficial. Assume you are writing an executive summary of a grant application in a two- to three-page document.
   b. Consider what advantages the adaptation will offer over and above the program as it is delivered face-to-face. Specify what each advantage will be and why you think achieving this advantage will serve as an improvement over the current program.
   c. Discuss specific limitations that you anticipate to the adaptation for the DPP program to a technology-based content delivery.
   d. Identify specific theoretical constructs that will be useful to evaluate to improve on our understanding of the processes for behavior change in the technological environment.

ADDITIONAL RESOURCES

Additional readings on health promotion programs and interventions delivered using technology:

Books, Articles, and Other Peer Reviewed Literature

Resource	*Description*
Kroeze, W., Werkman, A., & Brug, J. (2006). A systematic review of randomized trials on the effectiveness of computer-tailored education on physical activity and dietary behaviors. *Annals of Behavioral Medi*cine, *31*(3), 205–223.	This article describes current knowledge about how effective "expert systems" and tailoring are for influencing physical activity and diet.
Myung, S. K., McDonnell, D. D., Kazinets, G., Seo, H. G., & Moskowitz, J. M. (2009). Effects of web- and computer-based smoking cessation programs: Meta-analysis of randomized controlled trials. *Archives of Internet Medicine*, *169*(10), 929–937.	This article describes what we currently know about using computers for smoking cessation.
Neville, L. M., Milat, A. J., & O'Hara, B. (2009). Computer-tailored weight reduction interventions targeting adults: A narrative systematic review. *Health Promotion Journal of Australia, 20*(1), 48–57.	This article describes what we currently know about how effective "expert systems" and tailoring are for promoting weight loss—the work includes more qualitative assessment and program descriptions.
Neville, L. M., O'Hara, B., & Milat, A. (2009). Computer-tailored physical activity behavior change interventions targeting adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 3*(6), 30.	This article describes current knowledge about effective "expert systems" and tailoring for influencing physical activity.
Noar, S. M., Black, H. G., Pierce, & L. B. (2009). Efficacy of computer technology-based HIV prevention interventions: A meta-analysis. *AIDS, 23*(1), 107–115.	This article looks at multiple computer-based interventions and how effective they are for HIV prevention; the majority are computer programs—two are Internet based.
Portnoy, D. B., Scott-Sheldon, L.A., Johnson, B. T., & Carey, M. P. (2008). Computer-delivered interventions for health promotion and behavioral risk reduction: A meta-analysis of 75 randomized controlled trials, 1988–2007. *Preventive Medicine, 47*(1), 3–16.	This article considers the effectiveness of computer-based programs in general and the evidence of how well they work for influencing multiple behavioral outcomes.

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