# Rethinking Communication in the E-health Era

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## Abstract

There is substantial epidemiological evidence that widespread adoption of specific behavior changes can significantly improve population health. Yet, health communication efforts, while well intentioned, have often failed to engage people to change behavior within the complex contexts of their lives. 'E-health communication', health promotion efforts that are mediated by computers and other digital technologies, may have great potential to promote desired behavior changes through unique features such as mass customization, interactivity and convenience. There is growing initial evidence that e-health communication can improve behavioral outcomes. However, we have much to learn about whether the technical promise of e-health communication will be effective within the social reality of how diverse people communicate and change in the modern world. This article examines current evidence concerning e-health communication and evaluates opportunities for e-health applications.

## Keywords

*e-health, health behavior, health communication, health informatics, health interventions, participation*

7

NEARLY EVERY SUMMARY report on health communication mediated by the use of computers and other e-health technologies asserts its 'great potential' to cut costs and improve the health of the public (Institute of Medicine, 2001a; National Research Council, 2000; Science Panel on Interactive Communication and Health (SPICH), 1999). These reports also cite the many barriers that may prevent reaching this potential. We need only examine the many discouraging outcomes based on the use of traditional health communication to be concerned about our ability to succeed with new media (Snyder & Hamilton, 2002). The purpose of this article is to review past performance with health communication interventions, identify weaknesses in traditional approaches and evaluate theoretical and evidence-based directions for doing better with e-health communication.

## Why we need to do better with health communication

As US health care costs increase to over US$1 trillion per year, it is critical to find ways to prevent disease and reduce growing demand on the modern health care system (Health Care Financing Administration, 2000, http://hcfa.hss.ga/stats/nhe-oact/hilites.htm). An estimated one-half of all deaths each year are attributed to such preventable behavioral and social factors as unhealthy diets, smoking, alcohol abuse and inadequate exercise (McGinnis & Foege, 1993). During the past three decades, we have made substantial progress in understanding how specific personal actions can improve population health. For example, researchers estimate that if people were to follow currently available cancer prevention and early detection recommendations, national cancer mortality would be reduced by as much as 60 percent (Colditz, DeJong, Hunter, Trichopoulos, & Willett, 1996; Willett, Colditz, & Mueller, 1996).

Our challenge is to use this body of epidemiological knowledge to create sophisticated public health interventions that will actually succeed in changing people's behavior. There is evidence that we have made modest progress in about half of the US *Healthy People 2000* objectives (National Center for Health Statistics (HCHS), 1996). However, many behavioral statistics are discouraging: only 24 percent of Americans engage in light to moderate physical activity as recommended (HCHS, 1996) and almost 60 percent of American adults are overweight, a major contributing factor to the growing 'epidemic' of type 2 diabetes (Mokdad, Serdula, Dietz, Bowman, Marks, & Koplan, 1999; Must et al., 1999). Emmons (2000), in a review of behavioral interventions, commented that even among people who have been diagnosed with a modifiable chronic illness, there is an astonishingly low rate of action to control disease. For example, only 30 percent of white hypertensive men act to control their blood pressure (USDHHS, 1999). An Institute of Medicine report concluded that, 'Behavioral and social interventions offer great promise to reduce disease morbidity and mortality, but as yet their potential to improve the public's health has been relatively poorly tapped' (Smedley & Syme, 2000).

Our primary interventions to change behavior have been through health communication, the central social process in the provision of health care delivery and the promotion of public health (Kreps, 1988). Traditional health communication consists of disseminating messages from experts to the public in the hope of motivating the public to change specific behaviors, such as exercise, diet or smoking. The messages are based on decades of scientific research leading to the identification of risk factors for disease. In the USA, as in other industrialized counties, risk factors and concomitant healthy behaviors are set into national goals such as the US *Healthy People 2010* (USDHHS, 2000) and Canada's Framework for Health (Epp, 1986). Unfortunately, many of our health communication efforts have not succeeded (Kreps, 2001; Snyder & Hamilton, 2002).

One striking example is the California 5 a Day for Better Health! campaign that promotes increased fruit and vegetable consumption (Foerster & Hudes, 1994). The campaign is based on the finding that people who eat five or more servings of fruits and vegetables daily have greatly reduced risk of cancer, heart disease, diabetes and hypertension (USDHHS, 2000). The intervention involves a multimedia education campaign enlisting the cooperation of over 800 food industry food groups, local health departments and other educational partners. The campaign was designed using approaches from three

current models of behavior change: the Health Belief Model, the Social Learning Model and the Transtheoretical Model.

After five years of this intensive, statewide intervention, a careful study showed that knowledge about the importance of eating more fruits and vegetables substantially increased during this time (Foerster & Hudes, 1994). However awareness did not translate into behavior change. There was no increase in fruit and vegetable consumption in any population group. Discouragingly, among Hispanic adults, consumption actually dropped by 18 percent. These are sobering results from a 'state-of-the-art' communication initiative.

In other educational interventions aimed at consumers, disappointing results have also been found (Witte, Cameron, Lapinski, & Nzyuko, 1998; Curro, Lanni, Scipione, Grimaldi, & Mastoriacovo, 1997; Gochman, 1997; Assaf, Cummings, Graham, Mettlin, & Marshall, 1985; Heller, Elliott, Bray, & Alabaster, 1989; Kirby, Harvey, Claussenius, & Novar, 1989; McQuail, 1987; Neuhauser, Schwab, Syme, Bieber, & Obasksi, 1998; Powell, Tanz, Uyeda, Gaffney, & Sheehan, 2000; Silvestri & Flay, 1989; Stergachis, Newmann, Williams, & Schnell, 1990; Walpole, Watson, Moore, Goldblatt, & Bower, 1997).

Another disturbing issue is the increasing health disparities that result in a disproportionate burden of disease among minority groups (House & Williams, 2000). For this reason, it is particularly urgent that we ensure that interventions are effective across racial, ethnic and gender groups. Overall, the poor behavioral outcomes of many health promotion intervention efforts call into question the effectiveness of our health communication approaches, the models upon which they are based and the billions of dollars we continue to invest in such interventions. Why are our scientifically sound messages not more effective in engaging people to change behavior? As we move into the e-health communication era, there is a pressing need to do better.

## Improving behavioral outcomes through health communication

The challenge of changing behavior is so daunting that it is perhaps not surprising that

outcomes of health communication interventions have been disappointing. Northouse and Northouse (1998) describe health communication as a process that seeks to change a person's physical, psychological and social world. As a public health goal, these changes must extend to entire populations. While health communication cannot be expected to have sufficient power to change society to meet all our expectations for improved health, research suggests that we can do better.

The less than desired outcomes of many health communication interventions have become a topic of intense examination and speculation during the past decade (Airhihenbuwa & Obregon, 2000; Emmons, 2000; Ferguson, 2002; Neuhauser, in press; Rubin & Rubin, 2001; Weinstein, 1993). It would be desirable to have one framework in which to examine these failures and consider the potential of e-health communication strategies. Instead, we have dozens of models that seek to explain various attributes of health communication and behavioral health. No single model or group of models has yet demonstrated the predictive power to serve as a fundamental framework.

### Traditional health behavior models and interventions

Health behavior models that have shaped health communication strategies are drawn primarily from the fields of communication, psychology, sociology and medicine. These models are heavily influenced by literatures on relational communication, persuasion and social marketing (Kreps, Bonaguro, & Query, 1998).

'Classic' theories/models of health behavior include: the Health Belief Model, the Theory of Reasoned Action, the Transtheoretical Model, Learning and Conditioning, Social Learning Theory, Decision-making Theory and Diffusion of Innovations (for reviews see Ferguson, 1998 and the Institute of Medicine's report on Health and Behavior, 2001b). Although each model has its distinctive features, the models share the objective of predicting and explaining individual health-related behaviors. For example, the Transtheoretical Model posits 'stages of change' in which a person moves from 'precontemplation' to 'action' to 'maintenance' of a behavior change such as quitting smoking. The model advises that communication strategies be

9

tailored to an individual's level of readiness to change. The Health Belief Model assesses a person's likelihood of undertaking a preventive health behavior (such as getting an immunization) based on the person's perceptions of susceptibility to disease, benefits of the proposed action and barriers to making the change.

Most of the models tend to emphasize the individual as the decision-maker, rather than the influence of the larger social context (Airhihenbuwa & Obregon, 2000; Ferguson, 1998; Yoder, Hornik, & Chirwa, 1996). Of the dominant models, only the Theory of Reasoned Action and the Diffusion of Innovations include variables related to the influence of 'important others' (Rogers, 1995; Weinstein, 1993). As a result, health communication interventions have tended to focus on expert-driven, risk-based information and rational decision making by individuals about discrete behavior change (Guttman, 2000). The primary strategies used have been interpersonal communication (individual advice or group counseling), mass media communication (print, television and radio) and combinations of these strategies for community interventions.

Since the 1980s, behavioral science has begun to incorporate concepts of social epidemiology and there has been a major shift in health promotion toward a *social ecological paradigm* in which more attention is given to the social, institutional and cultural contexts that affect people's behavior (Stokals, 2000). This model acknowledges the powerful effects of social norms, peers and family on individual behaviors and is reflected in the new generation of multi-level health communication interventions.

In general, the narrowness of the models does not provide a sufficient understanding of why and how people (from diverse age, gender and cultural groups) make changes. As a result, Weinstein (1993) concludes that the models may predict the 'attractiveness' of taking an action, but this is not sufficient to predict what people will do. The models do not provide 'testable predictions about the process that leads to behavior change'. Emmons (2000) suggests that improving models will require a greater understanding of how mediating variables of behavioral change are affected by socio-cultural influences.

## Lessons learned about health communication and behavior change

Research on health communication interventions and models provides the following guidance on improving their behavioral outcomes:

1. *Health communication is more effective when it reaches people on an emotional as well as a rational level.* One of the major challenges of behavioral research is to identify the psychosocial factors that mediate change. Traditional models and interventions focus heavily on calculations of disease risks and health benefits, and assume that people make decisions on a rational basis. However, communicating 'risk' alone does not usually engage people to change behavior. This approach ignores important psychosocial motives, other than 'hazard reduction', such as emotional experience, self-esteem, security, inclusion, affection, control and social approval (Freimuth, Linnan, & Potter, 2000; Rubin & Rubin, 2001). Freimuth (1992) notes, for example, that most adolescents and many adults are capable of discounting risks and optimistically perceiving themselves as invulnerable to harm. From recent research, it appears that 'self-efficacy' and 'perceptions of control' are emerging as the strongest mediators of behavior change (Bull, Holt, Kreuter, Clark, & Scharff, 2001; Institute of Medicine, 2001b; Syme, 1990). These mediating factors are thought to be enhanced by communication that evokes empathy and other emotions typical of interpersonal discourse (Kreps & Kunimoto, 1994; Northhouse & Northouse, 1998).

2. *Health communication is more effective when it relates to people's social or 'life' contexts.* Messages alone are usually not sufficient to help people make and sustain a life change. Most people would agree with the goal of exercising 30 minutes a day, but less than a quarter of us manages to do it. Traditionally, we have assumed that behavior change is simply a matter of making a personal decision. However, even when people intend to make a change, it is often difficult for them to figure out how to do so in the context of their lives. A low-income woman living in a

violent neighborhood may not have an obvious option to exercise. Although our messages are person-directed, the process of making and maintaining a life change is made within the context of family, community and cultural factors (Airhihenbuwa & Obregon, 2000; Ferguson, 1998; Kreps & Kunimoto, 1994; Yoder et al., 1996). For example, Delamater, Bubb, Davis, Smith, Schmidt, White and Santiago (1990) found that interventions involving family members improved diabetic metabolic control, whereas separate interventions with family members and patients did not (McNabb, Quinn, Murphy, Thorp, & Cook, 1994). Incorporating health communication into a life context is thought to have another important advantage. It may enable people to make changes across a range of health issues. The contextual approach is likely to be more effective at strengthening the mediators of change: people's sense of efficacy and control to make actual changes.

3. *A combination of the effectiveness of interpersonal communication and the reach of mass media communication is needed to change population behavior.* A commonly held 'precept' of health communication has been that interpersonal approaches are more effective in changing individual behavior, but they are too expensive and too limited in reach to have a population effect. Mass media approaches have broad reach for lower cost, but are usually not as effective in changing behavior (Backer, Rogers, & Sopory, 1992; Cassel, Jackson, & Cheuvront, 1998). However, Johnson, Meischke, Grau and Johnson (1992) argue that this 'institutionally supported dichotomy' is inaccurate; both kinds of communication are important and interrelated. Hornik's (2002) review of health communication and behavior change outlines a communication model in which mass and interpersonal media operate at individual, social and institutional levels needed to effect change. Napoli (2001) proposes that we can improve the outcomes of health communication by leveraging their synergistic contributions on the continuum of mass and interpersonal media.

4. *Tailored communication is more effective than generic messages.* One of the key findings of behavioral research is the importance of 'tailoring' or 'customizing' information so that it more closely meets the needs of the recipients. This approach has resulted in significantly improved communication outcomes (Kreps, 2000; Marcus, Nigg, Riebe, & Forsyth, 2000; Rimer & Glassman, 1997). According to Baum (2000), most of our interventions are 'inappropriately generalized' across such factors as gender, age and culture. Furthermore, many people lack access to information due to language, literacy, disability or other barriers. The increasing health disparities among vulnerable groups in the USA (USDHHS, 2000) and other countries (House & Williams, 2000) points to an urgent need to improve our communication approaches with diverse audiences.

5. *Interactive communication is more effective than one-way communication.* Passive dissemination of health information is the most common strategy and the least effective (Bero, Grill, Grimshaw, Harvey, Oxman, & Thomson, 1998). Messages from experts about people's needs to improve themselves may be unintentionally disempowering (Smedley & Syme, 2000). While people want knowledge and ideas to enhance their lives, receiving it in a perceived 'authoritarian' form from the medical, social work or political establishments may be off-putting. Communication is discourse and communication scholars have written extensively about 'agency-robbing' discourse (Becker, 1986; Bhattacharyya, 1995; Kline, 1999). Such communication may provoke negative feelings of fear, embarrassment and guilt, rather than empowerment (Kline, 1999). Leary (1955), in his classic human interaction model, posits that 'dominant' communication stimulates 'submissive' behavior in the receiver—the opposite of empowerment required for behavior change.

Social influence theory suggests that there are two requirements for communication to be persuasive. It must involve a transaction between the sender and receiver—'a spiral of changing feelings and beliefs' (Smith, 1982, p. 5). This participatory process is thought to be necessary to 'internalize the message' to effect change (Cassel et al., 1998). The second requirement is

that the recipient drive the communication—that the communication be dependent on the participation of the receiver, not the sender (Simmons, 1976; Smith, 1982).

Therefore, interactivity may be the attribute of communication with the greatest implication for health promotion (Rice, 2001; Street & Rimal, 1997). While there is much that is unclear about the dimensions of interactivity, Street and Rimal (1997) believe that it is related to the user's control of the content and form of the communication and to the responsiveness of the communication to a user's prior actions. The importance of interactivity is related to the deeper value of participation in both the process and content of communication. Research shows that when the beneficiaries are involved in the design and dissemination of health communication, the outcomes are more likely to be successful (Neuhauser, in press).

Taken together, these findings suggest that our current interventions do not effectively 'touch the emotions' of people in ways that relate to their daily lives and promote change (Dede & Fontana, 1995). In others words, we experts have messages to send, but people have lives to live. There is increasing evidence that health communication approaches that are set within multiple social contexts and that engage people interactively and personally are more effective (Emmons, 2000). It is clear that we need to do better. Might e-health communication prove to have the power to transform behavior in a way that would improve population health?

## E-health: definition and scope

Eng defines 'e-health' as 'the use of emerging information and communication technology, especially the Internet, to improve or enable health and health care' (2001, p. 1). This term encompasses a range of overlapping disciplines that relate to the application of information, computer and communication technology to health care or population health. The fields include medical informatics, telehealth, telemedicine, consumer health informatics, public health informatics, among others (SPICH, 1999). The nature and functions of e-health communication are expanding rapidly,

and are therefore difficult to define precisely. E-health communication strategies include, but are not limited to: health information on the Internet; computer assisted learning; online support groups; online collaborative communities; information tailored by computer technologies; computer-controlled in-home telephone counseling; bio-metric assessment and transmission; and patient–provider e-mail contact.

## Imagining the potential for e-health communication

Marshall McLuhan (1964, p. 23) asserted, famously, that 'The medium is the message'—that media characteristics profoundly influence the impact of communication. According to McLuhan, new media do not just add to other media; they 'transform' human affairs. Decades before the technological explosion that would establish the Internet, McLuhan had a vision of a 'global village' in which 'a creative process of knowing will be collectively and corporately extended to the whole of human society, much as we have already extended our senses and our nerves by the various media' (1964). Today, McLuhan's vision is partially realized with the worldwide development of 'global villages'. These online communities or 'electronic commons' have created what Garner and Gillingham call a 'vast, important meeting place for conversations across time, space, and culture' (1996).

How different is this communication paradigm from our traditional one of experts delivering narrow, risk-based messages to the public, in a way that is often devoid of social and emotional meaning? E-health media could address some of the limitations of traditional health communication through improved customization, contextuality, interactivity and mixed media. Theoretically, e-health communication could combine these features, unlike our current 'segmented' approaches. Overall expected benefits might include: more intense personal engagement and participation of the users; widespread dissemination; information that is customized for and accessible to diverse audiences, especially traditionally underserved groups; access to information on demand '24/7'; linkages to others for social support; and information that relates more realistically to life

issues (Caplan, 2001; Emmons, 2000; Eysenbach & Diepgen, 2001; Ferguson, 1996; Institute of Medicine, 2001a; Marcus et al., 2000; Rubin & Rubin, 2001; USDHHS, 2000). E-health communication has the potential to address the five aforementioned criteria for successful health communication.

## Psychological factors that mediate change

E-health communication is expected to have much greater influence on the psychosocial factors of control, self-efficacy and motivation than has traditional health communication (Rubin & Rubin, 2001; SPICH, 1999; Strecher, Kreuter, Den Boer, Kobrin, Hospers, & Skinner, 1994). Empathy, which Ickes (1997) suggests is at the root of deep and meaningful communication, is demonstrated to be a strong feature of online groups (Preece & Ghozati, 2001).

## Promoting interactivity and participation

The interactivity of e-health communication, through online support groups, chat rooms and user-initiated searches, is expected to greatly enhance its ability to be transactional, responsive and participatory—and thus, more persuasive. Rubin and Rubin (2001) propose that the heightened involvement mediated by e-health features produces 'an activated motivated state' (Mittal, 1989) of readiness to select, interpret and respond to messages.

## Providing customized and contextualized information

Another advantage of e-health communication is its ability to tailor information to unique needs and attributes of individuals and communities (Kreps, 2000). These interventions use computer-based 'expert systems' to match information from a large database to a person's specific needs. The value of mass customization is supported by current cognitive theory that argues that learning is most effective and persuasive when tailored to an individual's beliefs and sensory preferences and when learning is situated in a context similar to that in which the knowledge will be used (Dede & Fontana, 1995; O'Keefe, 1990). Hawe (1998) proposes, provocatively, that specificity and contexts are at the core of newer paradigms of health promotion. Whereas the traditional view has been that transmitting knowledge to individuals will result in healthier behavior, a current concept is that people 'create health' within their own settings.

## Expanding the mix of media channels

According to Cassel et al. (1998), Internet-based communication may constitute a new 'hybrid channel', which combines the persuasive capabilities of interpersonal media and the broad reach of mass media. Other scholars propose that computer-mediated communication is more than a bridging of interpersonal and mass communication capabilities. It is an entirely new phenomenon—*hyperpersonal* communication (Walther, 1996). Further, hyperpersonal communication can be viewed as a radically new *system* that resists categorization into any previously described and that has potential beyond our current understanding (Caplan, 2001). The hyperpersonal communication system has unique characteristics of message receivers, senders and message processes. For example, recipients of messages can now also be publishers; people are no longer constrained by time and space in information exchange (Caplan, 2001). The new media help people create virtual social networks to share knowledge through collaborative learning and problem solving (Bandura, 2002), and even contribute to health research.

In effect, e-health communication combines, simultaneously, multiple features of traditional media, and goes far beyond to enable people to engage vividly and specifically with health concerns. Consider this scenario: rather than simply receiving the traditional brochure about managing diabetes, Enrique enrolls in an e-health program with his HMO. He measures his blood sugar with a home digital device and uploads the results, along with his diet and exercise diary, to his computer. The computer program informs him visually about his glucose management over time and relays the information to his HMO provider and to his electronic medical record. Enrique e-mails his provider about questions and uses the Web to make appointments. To understand how to manage his condition, Enrique and his wife watch a digital video in

13

Spanish and then take the interactive test. They participate in an online family support group to share experiences with others, and they look for research updates on a government website. Enrique has improved his diabetes management by 80 percent within the past year.

This 'visionary' scenario of the future is being tested in actual studies now and is precisely the highly participatory situation described by theorists as necessary for successful behavior change.

## Can e-health interventions improve behavior?

Because e-health interventions are a relatively recent phenomenon, they are not yet well evaluated (Robinson, Patrick, Eng, & Gustafson, 1998). Evaluation methods are also in the early stages of development (Eng, Gustafson, Henderson, Jimison, & Patrick, 1999; Kim, Eng, Deering, & Maxfield, 1999; Kreps, 2002; SPICH, 1999). However, there is a growing body of experimental evidence that documents the positive effects of e-health communication. Of particular interest are the findings of studies of shared decision making and tailored communication (Jones, Pearson, McGregor, Cawsey, Barrett, Craig, Atkinson, Gilmour, & McEwen, 1999; Rimer, Halabi, Skinner, Kaplan, Crawford, Samsa, Strigo, & Lipkus, 2001).

### Studies of shared decision making and tailored communication

Programs using shared decision making link patients with computer-mediated, specialized information to take more control of health conditions. Many of these studies have shown improved health outcomes and reduced use of medical interventions (Barry, Fowler, Mulley, Henderson, & Wennberg, 1995). For example, Dutton, Posner, Smigelski, Noonan and Friedman (1995) found that computer-controlled telephone counseling resulted in significantly reduced cholesterol levels. Using similar technology, Friedman, Kazis, Jette, Smith, Stollerman, Torgerson and Carey (1996) documented the low cost of a hypertension adherence program: US$5.42 per 1 percent improvement in adherence. Positive outcomes have been shown for women with breast cancer

and AIDS patients who used computers in the Comprehensive Health Enhancement Support System (CHESS) to access support groups and information about medical decisions (Gustafson, Hawkins, Boberg, Bricker, Pingree, & Chan, 1994; Gustafson, Hawkins, Boberg, Pingree, Serlin, Graziano, & Chan, 1999; Gustafson, McTavish, Boberg, Owens, Sherbeck, Wise, Pingree, & Hawkins, 1999; Gustafson, Wise, McTavish, Taylor, Wolberg, Stewart et al., 1993; McTavish, Gustafson, Owens, Wise, Taylor, Apantaku et al., 1994). These studies are particularly interesting because they showed effectiveness for low-income and minority users.

There is compelling initial evidence that tailored interventions that customize communication to personal attributes increase rates of behavior change (Bastani, Maxwell, Bradford, Das, & Yan, 1999; Brug, Glanz, van Assema, Kok, & van Breukelen, 1998; Kreps, 2000; Rimer & Glassman, 1997; Skinner, Campbell, Rimer, Curry, & Prochaska, 1999; Strecher et al., 1994. Bull et al. (2001) found tailored health education materials to be significantly more effective for weight loss interventions than nontailored materials. Likewise, Marcus, Emmons, Simkin-Silverman, Linnan, Taylor, Bock, Roberts, Rossi and Abrams (1998) found that tailored materials were more effective than standard interventions to improve physical activity. In another randomized, controlled trial, Marcus, Heimendinger, Wolfe, Rimer, Morra, Cox, Lang, Stengle, an Herle, Wagner, Fairclough and Hamilton (1998) demonstrated that tailored messages improved fruit and vegetable intake (something that has been very hard to do with traditional media). There is some support for the idea that iterative tailored communications may result in increased behavior change over single tailored communications (Brug et al., 1998).

Telephone-delivered interventions that provide motivational interviewing, counseling, reactive helplines or reminders using telephone and computer-generated voice response are another kind of tailored communication. In a review of 141 tailored message interventions, Kreps (2000) concluded that telephone-delivered tailored messages are generally showing better outcomes than tailored print materials. Some studies are showing that

combinations of tailored print and telephone-delivered interventions can be highly effective (Rimer et al., 2001).

There is growing evidence that tailored communication is effective with diverse audiences. For example, an innovative smoking cessation program among low-income African-Americans demonstrated significant benefits from materials tailored to the subject's gender, and stage of 'readiness to change' (Lipkus, Lyna, & Rimer, 1999). It is noteworthy that, in addition to smoking information, the intervention also included information about local daily living issues and life stresses—in keeping with the recommendations of the emerging social ecological paradigm.

## Analytical reviews

There are now a growing number of analytical reviews of e-health intervention outcomes. In addition to the reviews mentioned above, Revere and Dunbar (2001) examined 37 randomized controlled clinical trials and quasi-experimental trials of computer-generated interventions that used customized or tailored information disseminated by a variety of delivery devices. Of these interventions, 12 showed statistically significant behavioral outcomes, such as higher quit rates, increased physical activity, improved diet or increased immunization rates. The authors suggested that the studies with positive outcomes could serve as models to develop effective strategies to improve population health. In an earlier review, Lewis (1999) found 21 research reports that described computer technology used in patient education between 1971 and 1998. Of these studies, 16 showed a significant change in desired outcomes when patients participated in computer-mediated education. In a study of 80 clinical trials of patient–provider electronic communication, Balas, Jaffrey, Kuperman, Boren, Brown, Pinciroli and Mitchell (1997) found that 63 percent showed significantly improved outcomes for prevention and management of diabetes, osteoarthritis and other conditions. Krishna, Balas, Spencer, Griffen and Boren (1997) concluded that most studies of computer-based education show that they lead to health improvements and are well accepted by patients, including those from underserved populations.

The empirical evidence from our first decade of research on e-health interventions is encouraging. Studies show that communication mediated by computers and other digital technologies can result in positive outcomes across a wide range of behaviors. However, as shown by the analytical reviews, results are uneven. The studies are small and not necessarily representative of diverse populations. As yet there is little evidence about the sustainability of behavior changes facilitated by e-health interventions. There is little known about which design features affected the outcomes in the studies (Revere & Dunbar, 2001). Partly, this is because of the substantial methodological challenges involved in e-health research. In tailored interventions, each subject receives a different treatment, making it difficult to detect or interpret common mediating variables. In summary, while we have remarkably positive experimental effects, we do not have a robust e-health communication model to explain or predict the outcomes.

## Bridging e-health potential and reality

### The public and e-health communication

The problem with projecting a positive future from the foregoing analysis is that it assumes that people will have access to and use e-health communication as the study subjects did. But, in fact, a Pew Internet survey (Fox, Rainie, Horrigan, Lenhart, Spooner, Burke, Lewis, & Carter, 2000) found that for most Americans, e-health communication is limited to searching the Internet as a vast database for health information; few have access to tailored information, multimedia education, or other interactive tools. Stout, Villegas and Kim (2001) found few interactive tools available in their study of health websites. While, in 2001, 64 million Americans (59% of users) used the Internet to find health information, and the vast majority found it helpful, they were also concerned about issues of privacy and credibility (Horrigan, 2002). In August 2000, most people (91%) used the Internet to search for information about immediate health problems; only 13 percent used it for prevention issues (Horrigan, 2002).

There are important ongoing barriers to the public's access to and use of e-health

15

communication. Although the 'digital divide' is narrowing, the 'broadband divide' will restrict many people from accessing the rich multimedia and other interactive features of e-health communication. Literacy, linguistic, cultural and disability barriers are even more important issues. Eysenbach and Jadad (2001) cited the problem of high reading levels of Web material versus the low health literacy that is estimated to affect half of US adults. It is also difficult for many people to navigate the massive information on the Internet using a general search engine (Cline & Haynes, 2001). In an analysis of US websites, Lazaras and Mora (2000) found that only 2 percent used a language other than English, and less than 1 percent were usable by people with low-literacy skills. It is estimated that such barriers limit effective use by 50 million Americans. Further, lack of access is estimated to affect an estimated 30 million people with disabilities in the USA and 500 million worldwide who now use computers (Tobias, 2001).

There is little information about the impact of the Internet on people's health behavior. Although it is intriguing that half the respondents in a Pew survey (Fox et al., 2000) reported they made changes in diet and exercise due to Internet advice, there is no way to know the nature of the changes, nor to validate them. Evers, Cummins, Driskell, Sarkin, Prochaska, Prochaska, and Velicer (2001) assessed the types and quality of sites available to consumers for 'minimum criteria for health behavior change' drawn from the US Public Health Service sponsored Clinical Practice Guidelines. Only 8 percent of the assessed sites met the criteria. A related concern is quality. A recent study found that even credible websites showed only moderate accuracy of information on common health topics (Kunst, Groot, Latthe, Latthe, & Khan, 2002).

## Prospects for leadership and investment in e-health communication

Future investment in e-health communication is uncertain and the barriers are formidable. The e-health sector has been driven primarily by for-profit companies that produce sites for consumer health information and sales of health products. At this time, there are few public health-oriented e-health tools (Eng, 2001). And,

because there are currently few sustainable e-health revenue models outside of clinical care, even the current level of public health focus is in jeopardy (Eng, 2001). Unless e-health communication can demonstrate desirable cost–benefit outcomes, the health care sector is unlikely to make major investments in tailored or shared decision-making communication. In the public health sector, adoption of information technology and e-health initiatives has been very slow.

Fisher (1995) believes that free market forces will not be sufficient to produce the necessary US national health information infrastructure or e-health applications. Although various government agencies have played a major role in e-health research and program development, there has been no federal e-health coordinating agency or comprehensive plan (SPICH, 1999). In response to these concerns, the US Department of Health and Human Services has designed an ambitious strategy to develop the National Health Information Infrastructure (USDHHS, 2001). The report cites the many technical, human, financial, legal, ethical, political and research issues that are impeding the development of e-health systems and applications. However, it is uncertain whether the report's recommendations will be implemented.

In general, there seems to be a lack of consensus among US health professionals about the importance of e-health communication for behavior change. Goldsmith (2000) raises the concern that the US *Healthy People 2010* e-health goals focus on the dissemination of information—little attention is paid to using this medium to help people change health behaviors. Cassell et al. (1998) and Chamberlain (1996) also share the concern that public health professionals currently view the Internet primarily as a virtual clearinghouse for information and that there is limited attention as yet to the Internet as a site for public health intervention. They suggest that this may be 'due to the perception that the Internet is another form of mass media and therefore limited in its capacity to facilitate behavior change' (Cassell et al., 1998, p. 72). They argue that this view needs to be changed— that the Internet is a powerful global communication channel to conduct large-scale interventions aimed at modifying health behaviors.

16

# Implications for research, theory and practice

While advancing e-health communication for the public will require a massive public–private sector effort, there is a practical role for researchers and practitioners.

## *Research and evaluation*

There has been substantial research on health communication during the past 10 years. However, there is no formal US research agenda to investigate the impact of e-health communication on behavior change (SPICH, 1999). Research is particularly important to: measure the psychosocial mediators of behavior change; identify the best assessment variables to tailor messages and the most effective forms, channels and intensities of tailored communication for behavior change interventions; test e-health communication over the long term at the population level and in multi-cultural subgroups; and calculate cost–benefits (Emmons, 2000; Eng, 2001; Katz & Rice, 2001; Kreps, 2000). We need to adapt research design and statistical methods to handle the individualized nature of e-health communication. Multi-disciplinary collaboration will be essential; we may find our emerging worldwide 'hyperpersonal' electronic research networks very helpful.

## *Theory*

We have not yet developed a unified psychosocial theory or model to guide e-health development to promote behavior change (SPICH, 1999), and the old 'linear' models of one-way communication are out of date (Chamberlain, 1996). According to Rogers and Kincaid, new media effects would be more accurately described by a 'convergence model in which communication is defined as a process in which the participants create and share information . . .' (1981, p. 63). This effort will need to incorporate knowledge from disciplines such as psychology, health, sociology, education, computer science and advertising to build a model with more predictive power than those of the past.

There has been interesting initial work on creating analytical frameworks within the context of various communication and health paradigms. Street and Piziak (2001) propose a framework to guide development of Internet health programs in three areas: increased utilization; increased involvement; and improved health behavior. Napoli (2001) suggests that future analyses of how people use the Internet for health information should investigate sets of variables for both the chronology and also the psychology of use. Emmons (2000) has developed a multi-level framework to consider health behavior interventions within the broad social ecological model.

## *An idea for practice*

It is certainly hard to prioritize interventions from the vast inventory of e-health communication models. However, if our goal is to have a population effect, it would be important to reach most people where they are now—on the Internet. One idea would be to have the federal government, in partnership with private and non-profit sectors, establish a 'Google™ for Health'—a highly user-friendly Web portal and search engine to guide users to carefully selected health information and interactive tools. This would necessarily involve diverse users in the design of the browser and in improving the interfaces of current key sites like Healthfinder, and in the development of multimedia, interactive tools. As a result, it might help overcome some barriers underlying the digital divide and attract more users from underserved populations. For a relatively small initial investment and ongoing support, this could provide the public with easy-to-use, credible, interactive, relevant, private and secure information that could theoretically be expected to improve health. The UK, for example, is setting up a 'national knowledge service' to integrate high-quality, consistent information on websites (Eaton, 2002).

# Conclusions

There is a pressing need to improve the behavioral outcomes of health communication interventions. Although we have solid epidemiological evidence that widespread adoption of recommended behavior changes could greatly reduce morbidity and mortality, current health communication efforts have not consistently achieved desired effects. The focus on delivering generic, one-way messages from experts to individuals about disease risks has not effectively engaged people to make changes

17

within the complex contexts of their lives. At the heart of the matter is a difficult question: What kind of communication promotes behavior change? Research suggests that it must be participatory, deeply meaningful, empathetic, empowering, interactive, personally relevant, contextually situated, credible and convenient.

There is encouraging initial evidence that multimedia health communication efforts, including the use of computers and other e-health technologies can improve behavior change outcomes through features of mass customization, interactivity and convenience. However, we do not know whether current short-term positive experimental results will eventually result in long-term health improvements at the population level. This will require more rigorous examinations of e-health interventions and massive public–private investments to extend these new interventions to entire populations. Currently, there is a need for strong leadership and strategic planning to overcome the many technical, financial, legal, political and organizational barriers to achieving important population health promotion goals with multimedia e-health communication interventions. Meanwhile, what we do know, is that the public has actively adopted the Internet for health communication, and over half of these users *say* it improves their health (Fox et al., 2000). Perhaps what we will learn, eventually, is that the key to behavior change is for people to be in charge of the learning, deciding and sharing of health communication—that our 'messages' play only a small role. If this proves true, then the 'hyperpersonal' space, the first 'many-to-many' medium in history, may contain power beyond our imagination.

As researchers, we can make an important contribution to understanding e-health communication by advancing careful, long-term research. There is also much we can do to develop the theoretical foundations of e-health communication through models that incorporate ideas from many disciplines. Our biggest challenge in the e-health era is the same as before: determining the most powerful psychosocial mediators of behavior change, and translating those findings to successful communications efforts. We may be able to implement some discrete, cost-effective e-health communication interventions to support the public in the near term. For example, an easy-to-use Web portal leading the public to high-quality, secure, interactive sites would be a major contribution to what people say they want.

Harris (1995) predicts that we are entering a fifth era of communication in which media are changing from passive, closed and producer-driven to interactive, connected and user-driven. Rice and Katz (2001) caution that, ultimately, for e-health communication to be successful, its technical capabilities will have to conform to the social reality of the way people work and interact in their cultural contexts. It is our challenge to do our best to make this happen.

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