New directions in eHealth communication: Opportunities and challenges

Gary L. Kreps [a,*], Linda Neuhauser [b]

[a] George Mason University, Department of Communication, Fairfax, VA, USA
[b] University of California, Berkeley, School of Public Health, Berkeley, CA, USA

ABSTRACT

Objective: This article reviews key communication issues involved in the design of effective and humane eHealth applications to help guide strategic development and implementation of health information technologies.
Background: There is a communication revolution brewing in the delivery of health care and the promotion of health fueled by the growth of powerful new health information technologies.
Conclusion: The development, adoption, and implementation of a broad range of new eHealth applications (such as online health information websites, interactive electronic health records, health decision support programs, tailored health education programs, health care system portals, mobile health communication programs, and advanced telehealth applications) holds tremendous promise to increase consumer and provider access to relevant health information, enhance the quality of care, reduce health care errors, increase collaboration, and encourage the adoption of healthy behaviors.
Practice implications: With the growth of new and exciting health information technology opportunities, however, comes the daunting responsibility to design interoperable, easy to use, engaging, and accessible eHealth applications that communicate the right information needed to guide health care and health promotion for diverse audiences.

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1. Introduction

There is a communication revolution brewing in the modern health care system fueled by the growth of powerful new health information technologies (HITs) that hold tremendous promise for enhancing the delivery of health care and the promotion of health. The development, adoption, and implementation of a broad range of new eHealth applications, such as ubiquitous health information websites (such as Medline Plus, Healthfinder, and Web MD), online social support networks, interactive electronic health records, health decision support systems, tailored health education programs, health care system web portals, mobile health communication devices, and advanced telehealth applications, promise to increase consumer and provider access to relevant health information, enhance the quality of care, reduce health care errors, increase collaboration, and encourage the adoption of healthy behaviors [1]). With the growth of new and exciting HIT opportunities, however, comes the daunting responsibility to design eHealth tools that communicate effectively with a diverse array of health care consumers, providers, and policy makers. These tools must be designed to effectively communicate the right information needed by different audiences at the right time, in the

right place, and in the best ways to guide health care and health promotion. eHealth tools need to be interactive, interoperable, easy to use, engaging, adaptable, and accessible for diverse audiences [2,3]. This article reviews key communication issues involved in the design of effective and humane eHealth applications to help guide strategic development and implementation of HITs that will really improve the quality of care and the promotion of health.

While more health care consumers and providers now understand that communication is a central social process in the provision of health care delivery and the promotion of public health, many do not always recognize that effective communication is a complex and fragile human process that demands strategic design, careful monitoring, and responsive adaptation [4–6]. This is particularly true in the development and implementation of new health information technologies. Often, it appears that eHealth designers are more enamored with the technical elegance and innovation of new information technologies than with the utility of these tools for health care consumers and providers. Are the technologies easy for these audiences to understand and use? Do the new eHealth tools fit comfortably within the policies, practices, and technical infrastructure that are built into existing health and social systems? Are these new tools affordable and accessible for all intended audiences? Are the messages delivered on eHealth programs designed so that diverse populations of users can understand and apply the health information provided? Are the

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* Corresponding author. Tel.: +1 703 993 1090; fax: +1 703 993 1096.
E-mail address: gkreps@gmu.edu (G.L. Kreps).

information systems adaptive, interactive, and self-correcting? Do they provide interesting, relevant, and engaging information for users? Too often, the answers to these questions are disappointing.

2. Information technologies and behavioral health

eHealth tools have tremendous potential to encourage adoption of healthy behaviors by consumers to promote disease prevention, health promotion, and early detection [1]. Key behavioral factors (such as problematic lifestyle choices concerning diet, exercise, alcohol use, tobacco use, drug use, sexual practices, and exposure to environmental risks) are key contributors to many worldwide health problems (including obesity, injuries, diabetes, heart disease, alcoholism, sexually transmitted diseases, and cancers) that directly influence the "global burden of disease" [7]. The Institute of Medicine estimates that encouraging consumers to engage in early detection cancer screening could reduce rates of mortality from colorectal cancer by 30–80 percent among adults 50 and older, from breast cancer by 25–30 percent among women 50 and older, and from cervical cancer by 20–60 percent among women 18 and older [8]. Healthy People 2010 establishes national population health goals recommending the development of strategic health communication interventions to promote adoption of healthy behaviors and early detection screening [9]. The broad reach and potential influence of eHealth technologies are ideally suited to providing consumers with relevant motivational information about healthy behaviors. eHealth can supplement and reinforce health promotion messages disseminated via more traditional health education channels. However, eHealth tools have to be designed to complement other health communication channels, be easy for health care professionals to use, and communicate effectively with diverse audiences of consumers.

Unfortunately, despite a few isolated studies suggesting the efficacy of HITs for promoting adoption of positive health behaviors, population-level progress in promoting behavioral health has been painfully slow [1]. For example, the latest progress report for achieving the nutritional and healthy weight objectives from Healthy People 2010 show that these health outcomes either remained unchanged or have gotten worse [10]. Similar disappointing outcomes have been reported for influencing large-scale behavior change goals for managing diabetes and promoting physical fitness [11,12]. A recent Institute of Medicine report of communication interventions to promote health in the US concluded that while behavioral interventions offer great promise to promote public health, these interventions have been poorly developed and implemented [13,14].

3. The promise of eHealth communication

Since its inception in the late 1980s, eHealth communication has been thought to have great promise to improve upon traditional heath communication through user-centered design and interactivity, broad social connectivity, deeper understanding of what motivates behavior change beyond "risk," and the use of multimodal media that expand people's access to health information and discourse across time, place, and cultures [15]. eHealth communication offers opportunities for customization that were unimaginable a few decades ago. For example, health educators can use computer systems to select information from large databases and match it with an individual's attributes or preferences ("mass customization" or "computer-tailoring"). Computer-automated reminders about personal health care actions and appointments can be sent to patients by phone or e-mail. Online communities can create new social communities of people with similar health concerns. When users are further engaged as co-designers, there are unparalleled opportunities to

produce communication that is relevant to people's specific needs, preferences, and social contexts [16,17].

The vast array of eHealth technologies and applications including interactive websites, web portals, telehealth applications, e-mail, voice recognition, online communities, gaming, and many others are rapidly challenging the old, linear "expert message sender to receiver" approach. eHealth communication enhances the user's control of information searching, initiating connections with health providers, and linking with others in online spaces. Rubin and Rubin [18] proposed that the heightened involvement mediated by eHealth features produces an activated, motivated state of readiness to select, interpret, and respond to suggestions to improve health behavior.

eHealth technologies provide unprecedented opportunities for customized communication that Walther [19] refers to as "hyperpersonal communication." The broad access of eHealth channels enable "high touch" communication to also have high reach [1]. Digital technologies have sparked combinations of traditional media with new media that enable development of a new "hybrid medium" that combines mass and interpersonal communication [3]. For example, health care organizations can send individually tailored information to patients who can, at their own "24/7" convenience, respond, ask questions, request services, and even transmit their views and advice to virtual communities. Since each medium has its own individual strengths and weaknesses for effective health communication, we can mix media, to strengthen the personal meaning of information, and to extend its reach over large populations.

Consumers have rapidly and enthusiastically adopted the Internet as a primary channel for seeking health information [19–21]. As of March 2009, an estimated 1.6 billion people used the Internet. The global penetration rate was estimated at 23.3 percent, including the following regional estimates: North America, 74.4 percent; Oceania/Australia, 60.4 percent; Europe, 48.9 percent; Latin America/Caribbean, 29.9 percent; Middle East, 23.3 percent; Asia, 18.3 percent; and Africa 5.6 percent [22]. The usage rates represent a growth of 342 percent between 2000 and 2008. Andreassen et al. [23] report that 71 percent of Internet users (44 percent of the population-based sample) in seven European countries used the Internet for health purposes. In 2007, an estimated 67 percent of Internet users accessed health information [24]. In the US, 61 percent of Internet users (79 percent of all adults) searched for health information in December 2008 [25]. Internet usage among all populations is continuously increasing, although "digital divides" still remain for people who have less education, lower incomes, or who are older than 65. In 2009, 59 percent of US "e-patients" accessed user-generated health content, and 20 percent had created such content; 53 percent had looked at Wikipedia for health information, and 39 percent had used a social networking site [21].

4. Evidence from eHealth research on interventions?

In 2003, we reviewed the outcomes of the first decade of eHealth interventions and found promising results, particularly in the use of computer-controlled telephone counselling, personally tailored communication, and online support groups for promoting health [15]. These outcomes were linked to key eHealth features of enhanced user control, interactivity, information customization, and social networking. We tempered our general conclusions with important caveats that not all studies showed positive outcomes, and the results of controlled experiments did not reflect the larger reality of how large populations would use and react to eHealth communication. We noted that the significant digital divide posed a daunting barrier for the populations most in need of better health communication. Finally, we proposed the need for a more robust

eHealth communication model to predict and explain behavioral outcomes [15].

In the interim global Internet access has more than doubled, novel media modes have emerged, and eHealth research now includes thousands of studies [1]. Computer-mediated communication between patients and providers is thought to have good potential to improve patients' knowledge, confidence, health care interactions, and health decision-making [26]. National population-based surveys in the US found that in 2003, 7 percent of Internet users reported communicating online with a health care provider; the prevalence increased to 10 percent in 2005 [27]. Users of patient–provider communication were more likely to be Internet users with more years of education, residents of urban areas, and have poorer health status. Such patients were also more likely to have higher trust in their health care provider and in online health information, have health care coverage, and to be white, rather than black or Asian [28,29].

McMullan [30] reviewed studies that examined how patients' Internet health searches affected their relationships with their health providers and found three typical outcomes: (1) The health professional feels threatened by patients who bring in information and reacts defensively by asserting an "expert opinion" (professional-centered relationship); (2) the health professional and patient work together to find and analyze the information (patient-centered relationship); or (3) the health professional guides patients to reliable health websites (Internet prescription). Iverson, Howard, and Penny [31] investigated online health-seeking behaviors of patients at three osteopathic medical care facilities and found that 58 percent of the patients reported seeking health information online. More than half of these patients reported that the information changed the way they thought about health problems, and prompted them to change their behavior. Those patients also reported asking more questions during office visits, following physician advice more closely, and making self-directed dietary changes. Akesson et al. [32] conducted a systematic review of 12 studies about patients' subjective experiences using interactive health communication finding that patients felt eHealth applications improved their knowledge, confidence, and health, and that this enhanced "empowerment" strengthened their relationships with health professionals. Results from a nationally representative survey in the US [33] showed that 8 percent of respondents reported taking Internet health information to their physicians and thought that it improved their medical visits (if their physicians had good communication skills). Kivit's [34] qualitative study of health information seekers in the UK found that patients who thought the Internet information met their personal needs, also felt it complemented, rather than opposed, advice from their health care providers.

Clearly, there is a strong trend toward more patient control of health information-seeking and decision-making. For example, Hesse and his colleagues found that the majority of Americans go to the Internet first, rather than to a provider, for health information [35,20]. In a 2007 study in Portugal, people who used the Internet for health purposes rated it as their most important source of health information [36]. Although people are increasingly seeking out and using Internet information to make health decisions, not all research shows positive findings. One example is a study in the Netherlands [37] that examined the value of a self-care website for patients and caregivers. Findings showed that both patients and caregivers felt that, except for the e-mail consultation component, the site did not meet their needs. They wanted it to be easier to navigate and to offer more personalized information so they could make specific self-care decisions.

Our 2003 review showed overall positive results from the very limited number of eHealth interventions to improve people's diets and physical activity [15]. During the past 5 years there has been a significant increase in such research, and similarly positive findings. In a review of 12 randomized controlled trials (RCT) or quasi-experimental designs of computer-tailored dietary interventions, seven of the studies showed positive outcomes on dietary behaviors [38,39] systematically reviewed RCTs of computer-tailored education about dietary and physical activity behaviors. Although 20 of 26 nutrition studies showed positive results, only 3 of 11 physical activity interventions were successful. Norman and colleagues [40] reviewed 49 RCT or quasi-experimental studies of dietary, physical activity, and/or weight loss interventions. eHealth interventions were superior to control or comparison strategies in 21 of 41 studies (51 percent), 24 studies had indeterminate results, and in four studies comparison groups outperformed eHealth intervention groups. In a systematic review of RCTs for computer-tailored weight loss strategies, half of the 6 interventions showed significant positive results [41]. Vandelanotte et al. [42] reviewed RCT and quasi-experimental studies of website-delivered physical activity interventions and found that 8 of 15 studies showed improvements in physical activity, but positive results diminished after 6 months. In their review of RCT Internet-based physical activity interventions (most used computer-tailoring, self-monitoring, and feedback tools), van den Berg et al. [43] found that in 2 of 3 studies the Internet education group showed significant improvement in physical activity compared with similar participants on a waiting list. In four other studies, they found inconclusive evidence about the value of increased supervisor contact with participants.

Overall, the above reviews favor the outcomes of eHealth interventions for physical activity, diet and weight loss promotion, but not all were successful. The results of individual studies also highlight factors that may facilitate or hinder the success of computer-mediated strategies. Moore et al. [44] tested an Internet-based dietary intervention to promote weight loss and reduce hypertension. By 12 months, participants had significantly improved their diet and reduced their weight and blood pressure. However, only 26 percent of the original participants still used the website at 12 months. Those who used the site more often had better outcomes—suggesting a "dose–response" effect. Similarly, Petersen and colleagues [45] tested an Internet-based weight management program with 7700 workers. Results showed significant self-reported dietary improvements, such as a 20 percent decrease in junk foods and modest weight loss (2.4 pounds) in the intervention group; increased Web usage was associated with increased weight loss.

Studies are beginning to test fine points of eHealth information delivery. Kroeze et al. [46] found that although the vast majority of Dutch adults in a dietary study appreciated and used the computer-tailored information, they preferred the print to the CD-ROM versions. Another test of print vs. website physical activity interventions found no difference in behavioral outcomes [47]. In their study of a workplace program, Cook et al. [48] found that the Internet intervention received higher user ratings and was more effective in improving workers' diets than print materials, but not for increasing physical activity. Steele, Mummery, and Dwyer [49] concluded that face-to-face and Internet delivery modes showed similar results in improving participants' motivation to engage in physical activity. Tufano and Karras [50] suggested that Web-enabled cellular telephones and wireless personal digital assistants (PDAs) could be useful strategies to help people manage their weight.

One concern about eHealth physical activity studies is that many rely on self-reported outcomes. Carr et al. [51] used pedometers to document that participants using an Internet-delivered educational intervention took 1384 more steps per day than the control subjects. Likewise, Hurling et al. [52] used accelerometers and found that a test group who used an

automated, Internet-based physical activity program along with mobile phone technology showed a 2-h, 18-min per week increase in physical activity. In their Internet-based physical activity study of workers, Ware et al. [53] concluded that the use of interactive devices to measure activity and weight data was not only useful to document results objectively, but was also associated with motivating participants to use the site (the dropout rate was only 5 percent).

Recent studies are also investigating underlying psychological factors that may mediate change. In the aforementioned research by Hurling et al. [52], the test group reported higher perceived control and intentions to exercise. An eHealth study conducted by Lewis et al. [54] found that the group using computer-tailored physical activity information was much more likely to logon to the site than a control group using standard information. The test group credited customized, interactive features such as goal-setting and self-monitoring with their motivation to engage with the information. A new area of investigation is the ecological factors that may influence physical activity. Ferney et al. [55] found that Australians who used a local neighborhood environment-focused physical activity website had higher rates of walking than those using a more general motivational-information site.

Our earlier review found limited, but encouraging, evidence about the effectiveness of eHealth interventions for promoting the health of vulnerable populations. Current research continues to support the broad applicability of such interventions. An ethnically diverse sample of women using a tailored physical activity website showed twice the activity gains of a control group [56]. In a Canadian study, low-income patients with heart problems who used a health portal reported better dietary choices than a control group [57].

Increasingly, researchers are investigating the outcomes of health interventions on multiple health behaviors. A meta-analytical review of 24 randomized controlled trials of interactive health communication for people with chronic diseases showed that they were more effective than standard interventions for improving people's knowledge, self-efficacy, social support, and improvements in exercise, and reductions in smoking [58]. de Vries et al. [59] found that computer-tailored printed letters were more effective than standard letters in improving Dutch participants' nutrition and physical activity, but smoking cessation rates were similar for both groups. A review of 14 interventions using mobile telephone short-message text service (SMS) to educate users about smoking cessation and diabetes self-management found that the features of interactivity and information tailoring were associated with short-term behavioral improvements.

A review of Internet-delivered smoking cessation interventions cited 106 websites and concluded that interactive sites were still underrepresented among the offerings [60]. Bock et al. [61] compared results of research reviews in 2004 and 2008 assessing the quality of information on web-assisted tobacco interventions. They found that although the percentage of sites offering at least one interactive feature increased from 39 percent in 2004 to 56 percent in 2008, sites could be improved through more personalization and linkages to social support and treatment contacts. In Norway, Brendryen and Kraft [62] compared a digital, multimedia smoking cessation intervention (e-mail, web pages, interactive voice response, and SMS technology) to a printed booklet. After 1 year, the eHealth intervention, aptly named "Happy Ending," showed significantly better improvements in smoking cessation than the print group. eHealth smoking cessation research is becoming more rigorous and sophisticated. A study by Rabius et al. [63] compared the outcomes of six Internet websites to explore how interactivity and tailoring affected outcomes, and found that depression may have a negative impact of people's effective use of tailored and interactive information. Houston and Ford [64]

developed a novel motivational feature that tripled participants' use of a smoking cessation site and increased their discussions with family about quitting smoking.

Web-based tailored asthma management interventions have worked well with adolescents [65,66]. Riper et al. [67,68] found positive results from a web-based self-help program for problem drinkers in the Netherlands. A review of internet-based interventions for traumatic stress-related problems found that eHealth interventions worked as well as in-person treatment programs. Another study found that participants using an Internet intervention significantly reduced symptoms of depression, especially if they received reminders to access the site [69]. An extensive and growing literature documents the largely positive behavioral effects of eHealth cancer communication, as well as important barriers of literacy, language, and culture [2].

5. Challenges to the development of effective eHealth communication interventions

Based upon our review of the relevant literature evaluating the applications of eHealth interventions we have identified four major communication directions for designing HITs to achieve their full potential for promoting health. First, eHealth interventions must be designed to maximize interactive communication with users to encourage their active involvement in health care and health promotion. Second, HITs must be designed to work effectively and transparently across different communication platforms and with diverse populations of users. Third, eHealth interventions must be designed to personally engage the interests and emotions of users to promote maximum message exposure and influence. Finally, eHealth applications must be designed to have broad reach across diverse populations, while at the same time adapting to the specific interests and communication orientations of different users.

5.1. Enhancing the interactivity of eHealth communication interventions

The traditional one-way, downward focused health messages that originate from experts and are directed to consumers to tell them what to do to improve themselves are often unintentionally disempowering [13]. While health care consumers generally want and need knowledge to help them make informed health-related decisions, the way the health information is communicated can have a powerful impact on how well it is accepted. Too often, the authoritative delivery of health information without active consultation with consumers is perceived as intimidating and off-putting [15]. Smith [70] suggests that effective health communication must involve an active collaborative transaction between the sender and receiver—"a spiral of changing feelings and beliefs." This participatory process is thought to be necessary to promote acceptance and internalization of messages to effect change [71]. To internalize the message, the recipients must actively participate in health communication. Effective health communication is dependent on active participation by both consumers and providers [70]. One of the advantages of eHealth communication over the use of more traditional print media is the ease of designing feedback mechanisms that promote interaction. However, too often eHealth applications are not designed to promote interaction and collaboration. They are often focused more on providing information than on exchanging messages.

Interactivity may be the communication attribute with the greatest power to improve health promotion [72,73]. While much is unclear about the dimensions of interactivity, Street and Rimal [73] believe that interactivity is related to the user's control of the content and form of the communication, as well as the

responsiveness of the communication to 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 beneficiaries are involved in the design and dissemination of eHealth communication, the outcomes are more likely to be successful [17,14,20].

Bunton et al. [74] argue that people's attitudes, values, and beliefs about health are a product of social interaction. People are more likely to seek cancer screening if it is an accepted practice in their social circle. Health behavior change – especially on a population scale – involves changing collective social practices. This requires a highly sophisticated understanding of dynamic social practices that takes into account the great diversity of subcultures in populations [15]. eHealth applications have the opportunity to connect consumers through social networking. Current uses of online support groups, health blogs, and web portals are helping to leverage the use of social interaction in support of health promotion. Future applications must be designed to build upon social networks to disseminate health information and influence health behaviors.

5.2. Increasing the interoperability of eHealth communication interventions

eHealth communication systems must be designed to work in many settings with a broad range of different consumers and providers. Complex health problems (such as cancers, heart disease, HIV/AIDS, and diabetes) often involve collaborative efforts between a number of health care experts, including primary care physicians, medical specialists (such as surgeons, anesthesiologists, oncologists, cardiologists, and dermatologists), therapists, nutritionists, pharmacists, and many others. Commonly, these experts work in different offices and different health care systems. Yet, all of these experts and the health care consumers need timely access to accurate health records information to effectively coordinate care. eHealth applications must be designed to work across the technical infrastructures used by these interdependent health care consumers and providers. Efforts to develop common eHealth standards are underway, but much needs to be done to enable seamless use of health information technologies by all stakeholders.

Since the beginning of this century, there has been a major shift toward a "social ecological" paradigm for public health that acknowledges the powerful social, institutional, and cultural contexts of people's behaviors [75,14]. However, although this model defines multiple levels of contexts, it does not well define the interactive processes between and among these levels. eHealth technologies must be designed to be interoperable across organizational and social contexts to connect consumers and providers and promote coordinated health promotion efforts.

5.3. Creating eHealth communication that is dynamic and engaging

We live in a rich and complex modern media environment. It is not easy to effectively capture audience member attention when there are so many competing messages. Traditional health communication has emphasized designing and delivering generic (one-size-fits-all) messages that are not specifically relevant to people's personal characteristics or their social settings [76]. As Baum [77] warned, communication is often "inappropriately generalized across such factors as gender, age and culture." Given the ever-increasing health disparities among population groups, it is critical to reduce communication barriers, especially those related to limited literacy, language, culture, or disability. The best health communication approaches are designed to match the unique characteristics, interests, and cultural orientations of intended target audiences, which means that effective interventions must be strategically designed for clearly segmented, homogeneous groups of people [4]. eHealth interventions must appeal to the unique interests and emotions of targeted audiences to capture attention and influence behaviors.

Low health literacy, for example, has emerged during the past two decades as an important communication problem [78,79]. The World Health Organization [80] defines "health literacy" as "the cognitive and social skills and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health." Results of the International Adult Literacy Survey, conducted in 25 countries, showed that low health literacy is a worldwide problem [81]. The Canadian Council on Learning [82] estimated that 60 percent of Canadian adults lack the capacity to obtain health information and make appropriate health decisions on their own. A national survey in the US found that about 90 million adults had limited health literacy abilities [83]. Obviously, health communication should be designed to closely match people's literacy levels [84]. However, over 800 studies document that most health information is written at levels that greatly exceed people's abilities to understand it [82]. eHealth interventions must be designed to communicate effectively with users regardless of their levels of health literacy. The use of appropriate and interesting language, graphics, video and audio clips can enhance the understandability and impact of eHealth messages. Furthermore, the application of narratives that actively engage consumers in dramatic and entertaining stories that they can identify with can enhance the influence of HITs.

While health communication generally has been "person-directed," the process of initiating and maintaining a life change is made in the context of family, community, and other cultural factors [85–87]. For example, Delameter and colleagues [87] found that health promotion activities that involved family members significantly improved diabetes control compared with those aimed only at patients. Incorporating health communication into a life context may also 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 [15]. Social network applications are ideally suited for connecting social networks for personally promoting health.

5.4. Designing communication to have the reach of mass media and the impact of interpersonal connections

Based on past health communication outcomes, a general conclusion has been that interpersonal approaches are more effective than mass media interventions in changing individual behavior, but interpersonal applications are generally too expensive and too limited in reach to have a population effect. Conversely, mass media approaches are thought to have broad reach for lower cost, but usually are not as personally engaging and effective in changing behavior [88,71]. However, Hornik [89], Napoli [90], and others think that the use of innovative eHealth applications can take advantage of the synergistic contributions of mass and interpersonal media needed to effect change on individual, institutional, and social levels.

The use of tailored health information systems delivered via websites and web portals, for example, have the potential to bridge both interpersonal and mass media forms of communication [3,4]. Tailored message systems promote interaction between users and computer systems that simulate interpersonal communication, enabling consumers to ask questions, receive answers, and also to respond to questions initiated by the computer system. Advances

in artificial intelligence guide the development of appropriate interactive message responses and queries that build upon stored information about computer users, as well as upon statements and answers to questions by users, so the interaction is pertinent, personal, and responsive [15,62]. The use of avatars can further enhance the personal interactivity of health information systems [91]. Interactive web features, such as live-chat and customer support also enhance the interpersonal interactivity of mass delivered HIT systems. By integrating interpersonal and mass media approaches to communication, eHealth applications can combine aspects of high touch and broad reach to health communication.

6. Discussion and conclusion

6.1. Discussion

The historic growth of health information technologies provides tremendous opportunities to combine the eHealth features of interactivity, customization, contextualization, and multimedia that have been touted as having the potential to revolutionize health communication. The first 15 years of eHealth research document that our efforts to bridge the theoretical potential and empirical reality of computer-mediated communication are gradually being realized. The promising, but limited, results of the first decade of such interventions are now gelling in their predictive power. As more of the world's populations enthusiastically embrace the Internet, the majority are seeking to improve their own and their family's health.

6.2. Conclusion

eHealth information that is interactive, interoperable, personally engaging, contextually tailored, with the ability to be delivered to mass audiences can really make a difference in enhancing the quality of health care and health promotion efforts. It can reach diverse audiences with information that matches their health needs and communication orientations. Health information can be easily updated and adapted to changing health conditions. It can foster greater participation between interdependent health care providers and consumers and insure that all crucial stakeholders in the health care enterprise have access to timely and accurate information to guide their decisions.

6.3. Practice implications

On a more sobering note, we still have a long way to go to achieve the potential of eHealth. With some exceptions, eHealth strategies are showing improved, but not stunning, results [1]. Many questions remain about how meaningfully eHealth applications can be used to influence health behaviors and coordinate the development of health care services. We certainly have not exhausted the potential of the eHealth space. Increasingly, consumers are depending on Internet to access health information and are embracing the broad use of mobile communication systems to access information and services. New technologies and eHealth applications are developing at a rapid rate. That is the emerging eHealth world. We still have much to learn about how to use these technologies and harness the explosion of social networking to enhance health decisions. However, by focusing on involving consumers in the design of eHealth systems, designing systems that can be seamlessly used across organizations and populations, developing engaging and motivating eHealth communication programs, and integrating high touch and broad reach in HITs we have to potential to dramatically improve health outcomes for diverse populations.

Conflict of interest

There are no conflicts of interest.

Role of the funding source

There is no external funding supporting the preparation of this manuscript.

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