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Interactivity and Presence of Three eHealth Interventions

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Abstract

A number of researchers have identified interactivity and presence as potentially important attributes of e-Health applications, because they are believed to influence users to interact with systems in ways that increase commitment, learning, and other desirable responses. This paper reports on the development of brief scales to assess the two concepts, and on use of them with participants in six conditions of a large-scale trial of interventions for breast cancer patients. Overall, the Internet scored very low on both measures. Versions of an integrated system of services (CHESS) scored higher, particularly as conditions added features to different versions of the system. Interventions involving a human Cancer Information Mentor scored highest, though even the Mentor was perceived as more interactive and having more presence when combined with the integrated eHealth system.

Keywords

Health psychology and medicine; Cognitive therapy; Specialized interventions; Mass media communications

The use of the Internet as a tool for many aspects of everyday life is coming to be taken for granted. Individuals seek and find entertainment, communicate with distant (or not so distant) others, seek information of all kinds, make purchases, plan and evaluate activities, keep up with events, seek opinions on topics of interest, and on and on. In the realm of personal health, the context of the present study, people seek help evaluating symptoms and anxieties for themselves and others, respond to diagnoses with information search both to orient themselves and to drive decision-making, seek guidance and comfort from the experiences and support of others, and employ practical tools to help manage diseases (Fox & Jones, 2009; Josefsson, 2006).

Although ease of access across time and place and a proliferation of services not previously available are clearly part of the Internet's appeal, researchers have for years argued that the Internet and other computer-based means of communication are most crucially different from traditional forms of mass communication in that they are interactive rather than one-directional. Although this idea has considerable intuitive appeal, saying just what 'interactivity' actually is has proved surprisingly elusive, and attempts have divided into roughly three groups. The simplest and often least conceptual simply ask users to rate the 'interactivity' of systems, often without providing any benchmark or definition for them. A second approach has focused

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instead on technical characteristics of systems, such as numbers of links, presence of email options, animation, or multi-media. But the approach that has the most potential in understanding and explaining Internet use as a communication activity instead sees interactivity as an attribute of communication exchanges, in this case between the system and its users.

Rafaeli (1988) first used this approach and distinguished 'reactive' from 'interactive' communication based on the degree to which the production of a given message reflected prior exchanges. Reactive communication responds solely to the immediately prior message, as when a vending machine responds to the button pushed. While human communication often contains such exchanges, Rafaeli argued that much more subtle, powerful, and interactive communication results when message creation takes account of the larger history of multiple prior exchanges: what the interactants know about each other from previous message exchanges. In a human-computer context, for the computer to hold up its side of interactivity requires it to have stored and processed aspects of prior behaviors both by itself and its human partner.

A related definition (Street & Rimal, 1997) distinguished two dimensions of interactivity for electronic health communication systems, user control and system responsiveness. User control refers to the user's ability to alter the form and/or content of the communication, and responsiveness refers to the computer-based system's ability to alter its messages to respond to differences in user behaviors. However, although it is obvious that computer-based systems usually offer greater user control than traditional electronic mass media (the starting place for Street and Rimal's comparison), the implication that greater user control necessarily creates greater interactivity is suspect. If the user is in full control of exchanges, then the system has none, leaving the user free to roam through information, but with the system contributing no more than availability. Thus, user control should better be understood as reciprocation and exchange between two agents who are both active, which Walther and colleagues (Walther, Pingree, Hawkins & Buller, 2005) summarize as indicating that interactivity requires the exchange of information, responsiveness, and some variation on user control.

In any event, the point is that interactivity is widely believed to enhance user involvement, improve learning, produce ongoing commitment to further exchanges, and increase system persuasiveness and other effects (Buller, 2004).

In recent years, several researchers have discussed the idea of 'presence' as an additional key attribute of computer systems, human perceptions of them, and interactions with them (Bioca, 1992; Lee, 2004). The idea began with virtual reality environments and user reports of perceiving that they were in a real space or interacting with real others, even though they knew that the spaces and others were distant or imaginary. Lee argues, and we agree, that interactivity is a necessary but not sufficient condition for the occurrence of presence, which is primarily a human perception. Although in gaming or work environments, physical presence, or the sense of being in a physically real place, is often important, Walther et al (2005) argue that it is social presence that has the greatest importance in health contexts. That is, when users perceive person-like qualities (caring, attentiveness) in e-Health systems, they may well seek further interactions, trust what they find, and find emotional support that relieves some of their disease-related anxieties.

Given the likely importance of interactivity and presence for e-Health systems, this paper reports the development and initial testing of an interactivity and presence instrument, and its performance in two clinical trials in which breast cancer patients were randomly assigned to eHealth interventions expected to vary in their degrees of both interactivity and presence. One of those trials focused on which parts of an eHealth system produced improved patient quality

of life, and the other on benefits derived from the interaction of the system with a human Cancer Information Mentor. Because the four-cell design of each trial contained two conditions overlapping with the other, there were a total of six experimental conditions between them.

Intervention summary

The eHealth system, CHESS, which had previously been tested only as a complete system (Gustafson, Hawkins, Pingree, McTavish, Arora, Mendenhall, et al., 2001; Gustafson, Hawkins, McTavish, Pingree, Chen, Volrathongchai, et al., 2008), contains a variety of components that can be classified into three groups.

Reactive Information

CHESS contains over a dozen individual services that all provide overlapping information about breast cancer, its treatment and consequences, dealing with the medical system, and broader life issues. A partial listing illustrates the different styles and formats of these services (i.e., FAQs, Library articles, Personal Stories, Resource Guide, Evaluating Web Resources, Calendar, My Journal), but the important shared characteristic is that the communication transaction is completely under the user's control. As is the case with much Internet content, the eHealth system is in many ways just a varied and readily accessible book, but provides no action of its own.

Communication

Two components, however, provide the ability to communicate with others. *Discussion Group* is an asynchronous bulletin board on which fellow breast cancer patients share experiences, provide support, and comment on all manner of topics in addition to breast cancer. Previous research with patients across a variety of health topics has consistently found this service used far more often than any other service (Gustafson, Hawkins, Boberg, Pingree, Serlin, Graziano, et al. 1999; Gustafson et al., 2001). A second communication service, *Ask an Expert*, allows the user to send questions (typically those too specialized to find answers within the Information services) to an NCI-trained Cancer Information Specialist, who answers within 48 hours and often sooner.

Interactive

In several services, the CHESS system takes on the more active role of coach or collaborator. In *Action Plan*, the user plans a behavior change and the system helps her evaluate factors that make success at that change more or less likely. *Healthy Relating* trains the user (and her partner) in managing relational stresses brought on by the cancer, and helps her communicate more effectively. *Easing Distress* uses cognitive-behavioral therapy techniques (Butler, Chapman, Foreman & Beck, 2006) to train the user to manage her emotional responses to cancer diagnosis and treatment. In each of these, although the user gains information, the point is that the computer provides evaluation and/or has its own agenda and goals that it brings to the communication, and thus that communication is interactive. In addition, when these interactive services were available, the system also employed a basic form of tailoring. Users were regularly prompted to list areas of concern and changes in treatments, and CHESS provided a focused version of the system centering on those issues, although the entire system remained available.

Mentor

In addition to the CHESS system, one of the two projects created systems and procedures for a human Cancer Information Mentor. The Mentor was an NCI Cancer Information Specialist (i.e., one of those who answer the 1-800-4CANCER Cancer Information Service), additionally

trained here. The Mentor called a patient 10 times during the six-month intervention, weekly at first and then monthly at the end. In these calls, the Mentor answered patient questions, but also helped her evaluate the information she got from various sources and suggested further search topics and strategies. The continuity of repeated calls further allowed the Mentor to build on past discussions.

Between these two studies (which shared two experimental conditions), participating breast cancer patients were randomly assigned access to one of six interventions: 1) loan of a computer (if needed), six months free access to the Internet, and training in Internet use and search strategies specific to breast cancer topics (all other conditions received this as a base), 2) a version of the CHES system containing only the *Reactive Information* components, 3) a version of CHES that added access to *Communication* components, 4) a version that further added *Interactive* components ('Full CHES'), 5) scheduled contact with a human Cancer Information Mentor, or 6) both Full CHES and the Mentor.

In general, we predicted that perceptions of the Interactivity and Presence of the interventions participants received would be lowest for the Internet, given previous research indicating little or no quality-of-life benefit for breast cancer patients (Gustafson, et al., 2008). Although carefully-vetted information for breast cancer patients does exist on the Internet, and some sites contain communication and interactive services, the level of integration and scientific support seen in CHES and similar systems is relatively rare. Instead, a patient searching on her own is likely to miss useful information in some areas but experience considerable redundancy in others as she moves from site to site and deals with varied navigational conventions. In addition, she must take account of sites with commercial goals or scientifically questionable claims. The net effect, we believe, will be to depress perceptions of both interactivity and presence in the Internet-only condition. We then predicted that these perceptions would generally increase in the order conditions were presented above, because of increasing feature-richness of CHES across conditions 2-4, and then because of the addition of live human contact in conditions 5 and 6. Due to the social nature of presence as measured here, we expected particularly sharp increases in presence between conditions 2 and 3 (with the addition of *Discussion Group* and *Ask an Expert*) and between conditions 4 and 5, where the human Mentor first appears.

Perceptions of additional interactivity and presence are predicted in condition 6, not just because the effects of CHES and the mentor add, but because each intervention will probably be changed from how it works on its own. This is most obvious for the Cancer Mentor, who knows only what the patient says when operating alone, but has the benefit of all CHES knows about the patient in the combined condition. Thus, the Cancer Mentor can tailor more effectively by being better able to track ups and downs and provide more tailored support. But it is also likely that the use of CHES, and thus its intervention, will be affected by the presence of the Cancer Mentor as well. The Cancer Mentor will provide support and help with the self-confidence to use an interactive system. The human reminder of CHES resources should make use of the system more likely overall and more focused in particular, guiding the patient to more effective use of the system (i.e., continuing to use information and tools instead of just communication).

Methods

Procedures

Between April, 2004 and April, 2006, 661 breast cancer patients were recruited from cancer centers in Madison, WI, Hartford, CT, and Houston, TX if they were within 2 months of diagnosis, not homeless, able to give informed consent, and able to read and speak English at a 6th-grade level. They were randomly assigned to one of six experimental conditions: 1) Internet only (n=112), 2) CHES information service only (n=118), 3) CHES information

and communication services only (n=109), 4) Full CHESS (n=111), 5) Mentor only (n=106), and 6) Mentor and Full CHESS (n=105). At 6 week post-test, the number of participants was 657, with two fewer in the Mentor and Full CHESS condition, and one less each in the Mentor only and CHESS information and communication services conditions.

After receiving the pretest and informed consent, the project director or site coordinator informed the study participant which arm of the study they had been randomized into and arranged a convenient time to deliver the laptop computer (if needed) to the patient's home. All study participants were offered a computer to use for six months or they could choose to continue to use their own computer with a CHESS browser installed to allow collection of use data. When requested, the study paid Internet access fees (both high speed and dial-up) up to \$30.00/month for the 6 months of study intervention.

Measures

Perceived interactivity and perceived presence—The primary variables of interest, perceived interactivity and perceived presence, were assessed at both pretest and 6 week post-test, though with different referents. At pretest, a four-item *perceived interactivity* scale ($M=2.32$, $SD=1.00$) developed for the current study asked respondents, on a five-point scale ranging from 0= *not at all* to 4= *very much*, items such as “the resources I used to get information and support about my breast cancer let me be in charge of getting what I needed.” (See Table 1 for complete list of items, Cronbach's $\alpha = .84$). Using the same format, a four-item *perceived presence* scale ($M=2.48$, $SD=1.10$) asked respondents questions such as “the resources I used to get information and support about my breast cancer gave me the sense of being watched out for” (Cronbach's $\alpha = .95$). (N.B. the generic referent in each case.) For these measures, average scores were computed.

Because the study's overall survey instrument was so long it posed a substantial burden, the pre-test was considerably shortened mid-study, and one set of items dropped were the generic-referent presence and interactivity measures. Therefore, pretest data were only available from the first 290 study participants. At the 6-week post-test, the items queried the same attributes, but they assessed perceptions about the particular medium or media each woman could access as part of the study: the Internet, CHESS, and the human information mentor.

Quality of Life variables

In order to examine correlations between perceived interactivity and presence and quality of life measures, this study additionally employed six health measures assessed at the pretest: Social support, Depression, Functional well-being, Cancer information competence, Healthcare participation, and Breast cancer-related concerns. Some of these measures have been used in previous CHESS studies and others have been widely tested and demonstrated in terms of reliability, validity, and responsiveness to clinical change (Brady, Cella, Mo, Bonomi, Tulsky, Lloyd, S. R. et al., 1997; Gustafson et al., 2001; Gustafson, McTavish, Stengle, Ballard, Hawkins, Shaw, et al., 2005). Average scores were computed for these measures. See Appendix for the exact wording of all the items belonging to these scales.

Social support ($M=3.39$, $SD=.66$), developed to assess perception of emotional and instrumental support (Gustafson, et al., 1999), was created using six items (Cronbach's $\alpha = .87$) that asked respondents, on a five-point scale ranging from 0= *not at all* to 4= *very much*, items such as “there are people I could count on for emotional support”.

Depression: A short eight-item CES-D (Center for Epidemiologic Studies Depression) scale (Radloff, 1977) was used to measure symptoms of depression ($M=.84$, $SD=.65$). Test-retest reliability and validity of this scale have been well-established. Respondents were asked, on a

four-point scale ranging from 0= *rarely or none of the time* to 3= *most or all of the time*, items such as “I felt depressed” (Cronbach's $\alpha = .88$).

A seven-item *functional well-being* scale ($M=2.62$, $SD=.79$) assessed the impact of breast cancer and treatment on quality of life; this scale was used and validated extensively in other studies (Brady et al., 1997; Cella, Tulsky, Gray, Sarafian, Linn, Bonomi et al., 1993).

Respondents were asked, on a five-point scale ranging from 0= *not at all* to 4= *very much*, items such as “I was able to work (including working in home)” (Cronbach's $\alpha = .86$).

Cancer information competence ($M=2.84$, $SD=.72$) (Gustafson et al., 2001; Gustafson et al., 2005) assessed a woman's perception that she could get and use health information (Cronbach's $\alpha = .81$). Five items asked the woman to agree or disagree, on a five-point scale ranging from 0 = *not at all* to 4 = *very much*, with statements such as “I know exactly what it is that I want to learn about my health care”.

A five-item *healthcare competence* scale ($M=2.90$, $SD=.72$) developed in our previous research (Gustafson et al., 2001; Gustafson et al., 2005) measured women's comfort and confidence dealing with physicians, other medical personnel, and health-care situations. We asked, on a five-point scale ranging from 0= *strongly agree* to 4= *agree very much*, whether they agreed or disagreed with statements such as “I felt comfortable with how actively I participated in my care”. All items were averaged to construct an index for healthcare competence (Cronbach's $\alpha = .83$).

A nine-item *breast cancer-related concerns* scale ($M=2.06$, $SD=.79$) assessed a breast cancer patient's emotional, physical, and body image concerns related to treatments and side effects; this scale had been validated in previous research (Cella et al., 1993; Gustafson et al., 2005; Shaw, Hawkins, Arora, McTavish, Pingree & Gustafson, 2006). We asked, on a five-point scale ranging from 0 = *not at all* to 4 = *very much*, whether they agreed or disagreed with statements such as “I was short of breath” (Cronbach's $\alpha = .60$). This scale lacks high internal consistency because the concerns are partially independent, but it nonetheless useful as a measure of overall degree of concern..

Demographics

Demographic characteristics including age, race, stage of cancer, education, and whether the woman had insurance or not were assessed at baseline. The sample analyzed in this study had a mean age of 52 years, and more than half of them reported at least bachelor's degree (4 year college) education. More than half of them were in the relatively early stages (stage 0, 1, 2) of cancer and only about one percent of the women did not have insurance. The racial/ethnic background of the sample included 88.4% Caucasian, 4.0% African American, 4.2% Latina/Mexican American, 1.8% Asian, and 0.9% Native American Indian.

Results

We first carried out factor analyses on the pretest responses to the eight items designed to tap Interactivity and Presence. At pretest, the principal components analysis produced only one factor with an eigenvalue greater than one (the second factor had an eigenvalue of .994), but forcing a second factor and carrying out a Varimax rotation resulted in a structure that divided the items exactly as expected (Table 1). In essence, all these items carried a positive loading tending toward a single factor, but the a priori conceptual distinction also was meaningful to the respondents.

At pretest, scores averaged a bit above the midpoint of the four-point scale for Interactivity (2.32) and perhaps even a bit higher for Presence (2.50). Not surprisingly, since this was before

any intervention, there were no significant differences between conditions (Interactivity: overall $F(5,321) = 1.14$, n.s.; Presence: overall $F(5,319) < 1$).

Table 2 presents perceptions six weeks later, after the groups each had experience with one or more of the three sources of breast cancer information and support. Note that although all groups had Internet access (and thus could report perceptions of the Internet), only four groups had access to some version of CHESS, and only two had access to a human Cancer Information Mentor. The overall prediction of increasing perceived interactivity and presence as the interventions offered became richer in features or added human mentoring was generally confirmed by monotonic increases moving down the table from upper left to lower right, with some but not all of the individual steps statistically significant. Interactivity of the Internet was lower in the Internet-only condition (1.64) than of even the simplest Information-only version of CHESS (1.80, n.s.), and as CHESS added features, its interactivity increased to 2.19 ($p < .05$) for the Information+Support version and to 2.50 (n.s.) for Full CHESS with coaching and training. The mentor was rated even more interactive on her own (3.07, $p < .001$) and even more so when she was accompanied by CHESS (3.28, n.s.).

Similarly, Internet presence (1.23) was considerably lower than even Information-only CHESS (1.66, $p < .05$), and the richer versions of CHESS had higher presence (2.28, $p < .05$ for the step to Information + Support, and 2.54, n.s. for the further step to Full CHESS.). As expected, the increase between the first two versions of CHESS was larger for presence than for interactivity. And the human cancer information mentor had greatly higher presence than any version of CHESS, either on her own (3.36, $p < .001$) or when combined with CHESS (3.45, n.s. for the final step).

Beyond these comparisons between interventions as the groups accessed richer resources, a different and complimentary picture emerges from examining each resource separately. Perceptions of CHESS interactivity increased as experimental conditions added content to the system, with the Information-only version significantly less interactive than either of the others. CHESS interactivity was rated highest when the patient also had access to a Mentor, and in that case was significantly higher than both the Information-only and Information+Support versions, but not significantly higher than Full CHESS alone ($p = .13$). The picture was similar for perceived presence, with Information-only CHESS rated lower than the other three versions or combinations, though with no significant differences between the latter three. Also note that perceptions of CHESS, if the information-only condition is excluded, are roughly those of the unspecified pretest resources (2.32 vs. 2.47 for interactivity, 2.50 vs. 2.46 for presence).

The Mentor was perceived as having both high interactivity and high presence (over 3.0 on the 0-4 scale, considerably higher than the unspecified pretest resource). Although these scores were slightly higher when patients also had CHESS, these differences were not significant.

Unlike the situation for the changing CHESS versions across conditions, Internet access was the same for all six groups, but perceptions of the Internet varied nonetheless, apparently depending on what other resources the patient could compare it to. The Internet was perceived to be most interactive (1.87) when the patient also had access to a human Mentor, with that perception significantly lower when the Internet was accompanied by any version of CHESS. Internet interactivity was rated at an intermediate level (not significantly different from either extreme) when the Internet was the only resource or when the patient had access to all three. The Internet's perceived presence was also highest with a Mentor (1.48), followed by when it was paired with the information-only version of CHESS, significantly higher than when patients had access to the two more complete versions of CHESS. Presence perceptions of the Internet's presence were intermediate when alone or accompanied by both a Mentor and CHESS, though its presence in the latter case was nearly as low as with the two complex

CHESS versions. It is also worth noting that ratings of Internet interactivity and especially presence were considerably lower than the pretest rating of unspecified resources (2.32 vs. 1.59 for interactivity, 2.50 vs. 1.19 for presence).

A final comparison between perceptions can be done within the one condition exposed to all three interventions, CHESS + Mentor (i.e., across the bottom row of Table 2), examining directly how patient perceptions of the resources differed when patients could compare all three. For both interactivity and presence, paired-sample t-tests found that Mentor scored higher than CHESS (interactivity: $t(79) = 5.82$; presence: $t(82) = 7.66$), and CHESS scored higher than the Internet (interactivity: $t(76) = 6.50$; presence: $t(76) = 8.16$), all four comparisons $p < .001$.

Given those results about randomized group differences in perceptions, Table 3 explores the source and meaning of those perceptions by correlating demographic characteristics and pretest levels of quality-of-life and health competence with perceptions of interactivity and presence, and the differences are revealing. Pretest interactivity and presence perceptions of unspecified breast cancer resources were unrelated to four demographic characteristics. But all measures of quality of life (social support, depression, functional well-being, breast cancer concerns) and health competence (information competence, health care competence) were significantly related, with those better off at pretest on all these measures perceiving more interactivity and presence in their breast cancer resources. These relationships were so consistent and strong that one must wonder at least a little whether the pretest measures of interactivity and presence were merely tapping generalized satisfaction with the initial response to the breast cancer diagnosis rather than specific perceptions.

However, the portions of the table dealing with 6-week perceptions of specific resources -- the Internet, the CHESS system, and the Mentor -- are far less populated with significant correlations, and those that are present are generally smaller than at pretest. Perceptions of Internet presence at six weeks were related to age (older), race (non-Caucasian), lower education, and to functional well-being and information competence. Internet interactivity was related to race (non-Caucasian), functional well-being, information and health care competence, but overall this indicated less relationship than at pretest. Six-week perceptions of CHESS were both significantly related to low education and higher health care competence and breast cancer concerns, with high depression being only related to perception of CHESS Presence. And women initially with higher social support perceived the Mentor as more Interactive and with greater Presence and those with higher health care competence perceived more Interactivity only.

The idea that perceptions of interactivity and presence are more concrete and real when applied to a specific intervention than applied to the pretest referent of "resources I used to get information and support about my breast cancer" was further reinforced when we repeated the principal components factor analysis of Table 1 on the 6-week data. We found unforced two-factor solutions for the perceptions of Internet ($N=355$) that exactly matched the pattern of Table 1. Results for CHESS ($N=232$) were consistent if we again forced a two-factor solution, and this was because one item ("took account of all the things I'd said or typed over time") was nearly evenly divided between the factors. However, forced two-factor solutions for Mentor were less clear than others, with six of 8 items (all presence with two from interactivity) on one factor. This could be because the Mentor sample was smaller ($N=119$) for a factor analysis of eight items, but it may also be that these items, developed for computer applications, were less clearly meaningful for perceptions of a human.

Discussion

The current study built on research designed to compare effects of different computer-based and human interventions on breast cancer patients' quality of life, social support, and competence dealing with health care information and the health care system. Because that study randomly assigned patients to six experimental conditions, we could explore patients' perceptions of the resources they received. In particular, given the focus on computer-based interventions, we asked respondents to assess the interactivity (degree of shared control and responsiveness) and presence (perceiving the interventions they received to have human qualities such as caring and attentiveness). Because every woman was provided with a computer, training, and Internet access (broad band where possible, dial-up otherwise), perceptions of the Internet form a base of comparison across conditions that also illuminates the Internet in contrast to the other interventions.

The first goal of this research -- to create simple survey measurements of Interactivity and Presence -- appears to have been largely met. The interactivity items tapped several aspects put forward in previous discussions of interactivity: user control, responsiveness, and use of accumulating interchange over time (Rafaeli, 1988; Street & Rimal, 1997), and these hung together well, both as indicated by simple measures of reliability (average Cronbach's $\alpha = .86$ across pretest and the three 6-week interventions), and by the ability to distinguish them from the presence measures through factor analysis in almost all cases. The social presence measures tapped aspects of presence (feeling attended to and understood) that were all highly related (average Cronbach's $\alpha = .96$) and were consistently distinct from interactivity.

Pretest associations of these beliefs (about the generic referent of "the resources I used to get information and support about my breast cancer,") with quality of life and health care and information competences (Table 3) were so consistent and positive as to suggest they were merely tapping global satisfaction with the woman's initial response to her breast cancer. But the less consistent and indeed somewhat surprising associations at six weeks both indicate that responses to specific referents were more meaningful and provide some information about their possible antecedents. Demographic characteristics were unrelated to these perceptions at pretest, but significant correlations for beliefs about the Internet and CHESS (though not the mentor) were present at six weeks. The correlations were not completely consistent in size or even direction across the two perceptions and the two resources, but overall interactivity and presence of these interventions tended to be higher for minorities and those with low education, which is quite at odds with the pretest quality of life and competence associations.

The latter associations were far less uniform at six weeks with the specific referents of Internet, CHESS and mentor. For the Internet, women who were better off at pretest still perceived more interactivity and presence, although this was limited to pretest functional well-being, cancer information competence and health care competence. Pretest social support, depression, and breast cancer concerns were unrelated to interactivity and presence. For CHESS, results were strikingly different. Perceiving CHESS as having interactivity and presence was associated with greater pretest health care competence, but not with information competence, functional well-being or social support. More surprisingly, CHESS interactivity and presence was higher for women who reported more breast cancer concerns at pretest and presence was greater for women who were depressed at pretest. Perceived interactivity and presence of the human Cancer Information Mentor was higher for women with more social support at present and for interactivity alone to health care competence.

These results suggest at least two important issues about perceptions of interactivity and presence. First, they were often higher for women one might ordinarily expect to do less well with a health crisis, let alone computer-based resources (i.e., older women, minorities, those

with less education), but those findings were not mirrored by correlations to quality of life measures one might expect to be associated with these demographic characteristics. And the differences between the intervention resources at six weeks suggest quite different sources of the relationships. Favorable perceptions of the Internet were more prevalent for women who reported greater functional well-being and competence at pretest, suggesting that simple access to Internet health resources is not universally easy but instead takes a measure of preparation and abilities. Perceptions of CHESS, on the other hand, were higher in several cases for women who were less well-off at pretest, suggesting that CHESS was able to address unmet needs. That the Mentor was perceived as more interactive and present for women already higher in social support and health care competence is something of a disappointment for us as intervention developers, as this intervention was supposed to compensate for weaknesses in information-handling abilities.

Because these breast cancer patients all had access to the Internet but then had additional access to varying versions of the CHESS system or to a Cancer Information Mentor, we predicted differences in both perceptions associated with increasing richness, communication content, interactive features of the system, and the presence of a human to interact with. For both interactivity and presence, ratings increased monotonically at all five steps (Table 2) as the six different conditions offered patients what we believed to be a more interactive/present resource (i.e., the move from Internet-only to add the simplest version of CHESS or the move from Full CHESS, a computer-based resource, to the gold standard of a human cancer information mentor), or as the experimental conditions offered richer versions of CHESS. In particular, all but the Information-only version of CHESS were significantly more interactive than the Internet, and even that version was perceived to have more presence. Adding CHESS communication services significantly boosted its interactivity and presence over the Information-only condition. And the human mentor had substantially more presence than even the richest CHESS condition.

Those initial results serve in part to validate the measures by demonstrating their sensitivity to what seem to be quite important differences in the five different interventions (leaving aside the combination of CHESS + Mentor for the moment). As a compliment, they also illuminate likely effectiveness differences between the interventions. As these differences have substantial resource implications for developers trying to use eHealth or human resources to benefit patients in particular and consumers generally, the degree to which each produces presence and interactivity bears on causal processes associated with each (e.g., as noted in the introduction, interactivity produces involvement, cognitive activation, and commitment to the system, presence produces trust, relieves anxiety, and leads to repeated system use. See also Pingree, Hawkins, Baker, DuBenske, Roberts & Gustafson, 2010).

Beyond this, however, perhaps the most interesting results come from examining how perceptions of these three resources changed when they were associated with one or more other resources, and the breast cancer patients had the opportunity to compare them. There are suggestions of such an effect for CHESS and the Mentor, though hardly the significant increases in perceptions for each that we predicted would result from them complimenting each other. Still, it may be worth noting that the interactivity of both CHESS and the mentor may be slightly higher when each can be seen in context of the other. Differences for presence are in the same direction but much smaller.

But this could be a small indication of the hoped-for synergy of those two resources: that knowledge gained by CHESS use allowed the mentor to be more effective, and mentor advice allowed for more effective CHESS use. And it is at least reassuring to us that perceptions of CHESS interactivity and especially presence were not lower in the context of a highly interactive and present human mentor.

The same cannot be said, however, for the Internet as a resource, as its ratings were affected both positively and (more often) negatively by comparison to other resources. When a breast cancer patient had access to any version of CHESS, her perception of Internet interactivity dropped sharply, even from its baseline far below the pretest ratings summarizing all breast cancer resources. This result is entirely consistent with outcomes research (e.g., Gustafson, et al., 2008) indicating that the Internet may be too chaotic and hard to use to benefit patients as much as an integrated system of resources like CHESS. Perceptions of Internet presence also, suffered, though not when combined with the Information-only version of CHESS. But then that version of CHESS itself lacks the coaching, training, and communication features that should produce social presence, and its presence ratings were quite low as well.

On the other hand, adding a human cancer information mentor seemingly transformed patients' experience of the Internet for the better. Interactivity and presence of the Internet were both highest (and significantly more than Internet ratings for the CHESS conditions) when the patient had the advice and support of a mentor. Since the mentor's role in her ten scheduled telephone calls (often supplemented or replaced by emails if patients wished) was specifically to guide and support information acquisition and interpretation, this suggests that the mentor was successful and that patients saw the Internet as a richer and more useful resource than when they had to deal with it on their own.

The value of studying people's perceptions of various resources goes beyond the context of eHealth campaign. Historically, most media effects research has focused on the effects of media content more than of media themselves, although it is also possible to study the nature of system in which the content is delivered (McLeod, Kosicki & Pan, 1991). As Eveland (2003) argued, "if we do not include some theoretical concept besides content in our formulation of media effects theories, then they are not media effects theories at all; they are content effects theories. What media effect researchers need to do is to develop theories of media effects, which will distinguish communication as a unique field" (p. 400). Thus, understanding what resources within an eHealth system produce more favorable perceptions is a critical element in assessing the effect because the effect of content won't be totally independent of the nature of the system and people's response to it.

That leaves us to question what kinds of benefits these perceptions of different resources would produce for breast cancer patients. For example, what are the optimal combinations among perceptions of resources that produce better outcomes in learning about disease? What are the best possible combinations that enhance psychological and emotional coping among patients? Perhaps only parts of the whole system are necessary and those could be provided to patients more cost effectively than the whole program. Additional analyses are under way to answer these questions, and the findings from those studies along with the current one will provide clearer pictures of how and why interactivity and presence enhance efficacy of health campaigns utilizing new technologies.

Appendix: Question wordings

Social Support, a 6 item scale (Cronbach's $\alpha = .88$). All items were scored on a 5-point scale (not at all, a little bit, somewhat, quite a bit, very much).

1. There are people I could count on for emotional support.
2. There were people I could rely on when I needed help doing something.
3. There are people who will help me understand things I am finding out about my illness.
4. I am pretty much all alone.
5. There are people who can help me find out the answers to my questions.

6. There are people who will fill in for me if I am unable to do something.

CES-D, an 8 item scale (Cronbach's $\alpha = .87$). All items were scored on a 4-point scale (rarely or none of the time, some or a little of the time, occasionally or a moderate amount of the time, most or all of the time).

1. I felt that I could not shake off the blues even with help from my family or friends.
2. I felt depressed.
3. I thought my life had been a failure.
4. I felt fearful.
5. My sleep was restless.
6. I felt lonely.
7. I had crying spells.
8. I felt sad.

Functional Well Being, a 7 item scale (Cronbach's $\alpha = .86$). All items were scored on a 5-point scale (not at all, a little bit, somewhat, quite a bit, very much).

- 9 I am able to work (including working in home).
- 10 My work (including work in home) was fulfilling.
- 11 I was able to enjoy life "in the moment".
- 12 I accepted my illness.
- 13 I was sleeping well.
- 14 I was enjoying my usual leisure pursuits.
- 15 I was content with the quality of life.

Breast Cancer Related Concerns, a 9 item scale (Cronbach's $\alpha = .61$). All items were scored on a 5-point scale (not at all, a little bit, somewhat, quite a bit, very much).

1. I was self conscious about the way I dress.
2. I was short of breath.
3. I was bothered by swollen or tender arms.
4. I felt sexually attractive.
5. My hair loss bothered me.
6. I worried about the risk of cancer in other family members.
7. I am able to feel like a woman.
8. I worry about the effect of stress on my health.
9. My change in weight bothered me.

Healthcare competence, a 5 item scale (Cronbach's $\alpha = .83$). All items were scored on a 5-point scale (strongly agree, agree, neither agree nor disagree, disagree, strongly disagree).

1. I thought about what was going to happen ahead of time
2. I felt comfortable with how actively I participated in my care.
3. I understand what was going on.

4. I knew the right questions to ask.
5. I went to the right healthcare provider at the right time.

Cancer Information Competence Scale, a 5 item scale (Cronbach's $\alpha = .81$). All items were scored on a 5-point scale (not at all, a little bit, somewhat, quite a bit, very much).

1. I know exactly what it is that I want to learn about my health care.
2. I can figure out how and where to get the information I need.
3. Health information is more difficult for me to obtain than other types of information (reverse coded)
4. I am satisfied with the way I currently learn about health issues.
5. I feel that I am in control over how and what I learn about my health.

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Table 1

Principal component analysis (pretest)

Items	Rotated factor loadings (Varimax)	
During the past month, the resources I used to get information and support about my breast cancer...		
Interactivity		
Allowed me to choose what kind of help I was getting.	.88	.24
Let me be in charge of getting what I needed.	.86	.31
Took account of all the things I'd said or typed over time.	.71	.38
Didn't make me wait too long for a response.	.58	.32
Presence		
Gave me the sense of being watched out for.	.35	.84
Felt like someone was talking with me.	.33	.87
Felt like someone understood me.	.36	.87
Made me feel listened to.	.32	.89
Eigenvalue	.99	5.23
Variance (%)	12	65

N=290

Table 2

Perceived interactivity/Presence for experimental groups after six weeks of intervention

	Randomized Groups	Perceptions of Internet		Perceptions of CHES		Perceptions of Mentor	
		Interactivity	Presence	Interactivity	Presence	Interactivity	Presence
Internet	Internet only (Ns=86-89)	1.64a,b	1.23a,b	-	-	-	-
CHES	Information service only (Ns=93-95)	1.47a	1.34a,b	1.80	1.66	-	-
	Information and Communication service only (Ns=71-73)	1.40a	1.05a	2.19a	2.33a	-	-
	Full CHES services (Ns=83-88)	1.48a	1.00a	2.50a, b	2.54a	-	-
Mentor	Mentor only (Ns=80-82)	1.87b	1.48b	-	-	3.07	3.36
	Mentor and Full CHES services (Ns=82-84)	1.70a,b	1.09a,b	2.71 b	2.57a	3.28	3.45

Note: Entries refer to means. Cells in the same column with different subscripts differ at $p < .05$ at the minimum by Scheffe post hoc tests.

Table 3

Correlations of Interactivity and Presence with Pretest Respondent Characteristics

	Pretest		6 Week					
			Internet		CHES		Mentor	
	Interactivity	Presence	Interactivity	Presence	Interactivity	Presence	Interactivity	Presence
<i>Demographics</i>								
Age	.11	.11	.05	.14**	-.03	-.04	-.06	-.04
Race (1=Caucasian)	-.01	-.02	-.19**	-.22**	-.11	-.08	-.15	-.06
Education	.08	-.05	-.06	-.25**	-.16*	-.24**	-.03	-.11
No insurance (yes=1)	.01	-.03	.00	.03	.07	.09	-.01	.01
<i>Quality of life variables (pretest)</i>								
Social support	.32**	.36**	.07	.08	.11	.07	.28**	.25**
CES-D	-.20**	-.16**	-.01	.03	.12	.14*	.03	.03
Functional well-being	.22**	.23**	.15**	.12*	.03	-.01	.10	.08
Cancer information competence	.42**	.45**	.17**	.13*	.05	.02	.17	.08
Health care competence	.29**	.33**	.16**	.08	.15*	.15*	.21*	.14
Breast cancer-related concerns	-.29**	-.25**	-.04	.01	.16**	.18**	-.03	-.09

* Note: $p < .05$,

** $p < .01$.