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Online health consultation: Examining uses of an interactive cancer communication tool by low-income women with breast cancer

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Abstract

Purpose—To examine how psychosocial variables predicted use of an online health consultation service among low-income breast cancer patients and in turn how using this service affected these same psychosocial outcomes.

Method—This retrospective study included 231 recently diagnosed, low-income (at or below 250% of the federal poverty level) breast cancer patients provided a free computer with 16 weeks of access to the Internet-based ‘Ask an Expert’ service offered as part of the Comprehensive Health Enhancement Support System (CHESS) “Living with Breast Cancer” program. The use activity included a total of 502 messages submitted to the online health consultation service. The data included five psychosocial variables: information seeking, social support, health self efficacy, participation in health care, and doctor–patient relationship, were collected at both the pre-test and 16-week post-test after using the service. Correlation tests were conducted to examine the relationship between pre- and post-test, and use activity. A multiple regression model was formed for each of five psychosocial variables to examine how use activity of the consultation service was associated with various psychosocial measurements.

Results—In total, 865 distinct consulting queries from 502 messages were identified as measurement of patients’ use activities (3.74 consulting queries per participant). Use activity had significant negative relationships with pre-test scores across all five psychosocial variables. The regression models found significant positive main effects (use activity) associated with three of these psychosocial variables: health self efficacy, participation in health care and doctor–patient

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Author contribution

Hsueh-Yi Lu (leading author, corresponding author) contributed to the most work of research design, coordination, data collection, data analysis, manuscript draft, revision, and final approval.

Bret R. Shaw contributed in giving advice and guide to the research design and data analysis, revising and editing manuscript and giving final approval.

David H. Gustafson contributed in giving mentoring on the study design and data analysis and giving advice on manuscript and final approval.

Conflict of interest

None declared.

relationship. Use activity of the online consultation service did not have significant relationships with the dependent variables of information seeking and perceived social support.

Conclusion—Low-income breast cancer patients sought out information from an online cancer information expert. Patients with more negative perceptions at pre-test tended to use the service more. Greater use of the service was associated with improvement in patients' perception of health self-efficacy, participation in health care and doctor–patient relationship. Moreover, use of online health consultation appears to level the differences, narrowing the gaps between those who were worse and better off at pre-test. These findings suggest that online health consultation can serve as an effective complement to other resources, which help low-income, breast cancer patients feel more confident to participate more actively in their health care, become more actively involved in making decisions about their treatments and enhance the relationship with their doctors.

Keywords

Consultation; Decision support; Communication; Breast cancer; Internet

1. Introduction

Breast cancer is the most common cancer among women in the United States and the second leading cause of cancer death [1]. Women diagnosed with breast cancer often desire more detailed information about their disease and treatment options and also to be more actively involved in the treatment decision-making process [2,3]. They often consult with other resources beyond their healthcare providers to seek additional information or opinions to confirm the prognosis as well as to feel reassured about their prescribed treatments [4,5]. Patients from underserved populations often experience even greater difficulties in accessing adequate information and decision support from healthcare providers due to limited income or lower education levels [6,7], leading to risks for lower knowledge levels, fewer opportunities to participate in care and less interaction with physicians [8–10].

A complementary form of support for breast cancer patients is a type of Internet-based communication service called “Online Health Consultation,” which serves as an alternative source of medical information for patients to cope with their illness beyond that provided by their clinicians [11–14]. This interactive service allows patients to ask questions related to their health care and receive tailored answers based on personal health characteristics and conditions from Cancer Information Specialists trained to give individualized information and support [15]. While patients use an online health consultation service, an ongoing relationship may be less critical than one between patients and their healthcare providers, as patients may not need to rely as much on online health specialists for ongoing care because patients generally have a primary physician with whom they discuss their ongoing care and their treatment decisions [16]. Through obtaining information from online resources, patients can compensate for their perceptions about the inadequacy of information or validate what they are provided by their health care providers and bring supplemental information to their doctors to facilitate more effective sharing of concepts, terminology, and treatment options, feel more involved in making their health decisions, and possibly enhance the existing relationships with their doctors [16–19]. Given the lack of accessibility to health information and decision support in many cases, online health consultation has promising potential to help low-income women coping with breast cancer.

Examining why patients use online health consultation services as well as whether such services may provide benefits is an essential step for strategically developing effective Internet applications that can improve how low-income patients access health care information, learn about their conditions, and make health care decisions [20,21]. In pursuit of these aims, this study examined low-income breast cancer patients' use of an online

health consultation service called ‘Ask an Expert’ offered as part of the Comprehensive Health Enhancement Support System (CHESS) “Living with Breast Cancer” program developed by the Center for Health Enhancement Systems Studies [14] at the University of Wisconsin – Madison. Five psychosocial health-related variables including information seeking, social support, health self efficacy, participation in health care, and doctor–patient relationship were measured as predictor and outcome measurements. This study analyzed whether those antecedent psychosocial variables could possibly predict the use of an online health consultation tool and how the use of the service may influence those psychosocial outcomes.

2. Ask an expert

The CHESS ‘Living with Breast Cancer’ program offered a set of computer-facilitated online tools including information, communication, and interactive services to help breast cancer patients cope more effectively with their illness (see Appendix A) [14,22]. As one of the communication services in the CHESS system, the ‘Ask an Expert’ service (Fig. 1) was a confidential, anonymous, asynchronous Web-based messaging tool that could serve as a secondary resource enabling patients to ask questions about their health and receive a personalized answer from the cancer experts separate from information provided by their current clinicians. Once a patient submitted a message to the Ask an Expert service, CHESS staff reviewed the message and assigned it to an expert who replied to it within two business days. The experts were Cancer Information Specialists trained by the National Cancer Institute (NCI) to use well-established medical textbooks (e.g., Diseases of the Breast) or computer resources (e.g., the NCI’s Physician Data Query database) to offer individualized responses to patients’ questions. In practice, those Cancer Experts provided objective, scientifically validated information and gave advice regarding what questions patients could ask of their clinicians and what topics they might discuss to better understand their disease and treatments. They explained to patients that they were not clinicians and it was not their role to provide advice on medical treatments or prognoses. The Cancer Experts also encouraged patients to discuss the provided information with their clinicians.

Previous studies have found that online health information and support services for cancer patients could empower more active participation in their healthcare and enhance their sense of competence in obtaining the information they needed [22–24]. However, this is the first study we are aware of to specifically examine how patients’ use of text-based online health consultation is quantitatively related with diverse psychosocial health outcomes.

3. Research questions

As online health consultation is expected to be a useful service for helping patients to seek information and reduce their uncertainty, this study examined how patients’ perceptions about their needs for information would predict use of the tool and in turn how the use of the tool could possibly influence patients’ perceptions about their needs for information.

Question 1: What are the relationships between use of an online consultation service and perceived needs for health information seeking?

Online health consultation is a patient-centered process that provides patients the opportunity to actively ask questions and express concerns related to their illness. This study proposes that the consultation tool could serve as a social support tool that provides patients with encouragement and emotional support and examines whether patients’ use of online consultation has a significant relationship with their perceptions of social support, leading to the second research question.

Question 2: What are the relationships between use of an online consultation service and perceptions of social support?

Significantly, patients can play an active role in communicating and interacting with an online consultation expert. While patients take an initiating role during the communication, it is expected that actively seeking information could increase their sense of autonomy in managing their illness and help patients make treatment decisions consistent with their preferences when choosing treatment options they feel good about. Some studies suggest that a patient-centered approach can result in improving health care quality along with the efficiency of health care delivery [25–27]. This study examines how the use of an online consultation tool can be predicted by or influence patients' perceived health self-efficacy and their perception of participation in their health care, leading to the third and fourth research questions.

Question 3: What are the relationships between use of an online consultation service and perceptions of health self-efficacy?

Question 4: What are the relationships between use of an online consultation service and perceptions of participating in their own health care?

By using the online consultation tool, patients may also obtain additional or compensative information outside that which is provided by their clinical providers and empower them to bring up those findings to their doctors during hospital visits. This information also may validate what they hear from their clinicians. Therefore, this study examined whether patients' use of online consultation could be predicted by or influence the relationship between patients and their primary doctors from the patients' perspective, leading to the final research question.

Question 5: What are the relationships between use of an online consultation service and the relationship between the patients and their doctors from the patients' perspective?

4. Methods

4.1. Data collection

Underserved women newly diagnosed with breast cancer were invited into the larger Digital Divide Pilot Project (DDPP) funded by the National Cancer Institute and the John and Mary Markle Foundation. Potential participants were referred from a variety of sources including hospitals and clinics, public health departments, self referrals, or Medicaid programs from rural Wisconsin or metropolitan Detroit. Once a participant was referred to the study, the research team reviewed the eligibility criteria and contacted the patient, described the purpose of the study, and explained the risks and benefits of being involved. Patients were eligible if they were at or below 250% of the federal poverty level, not homeless, able to give informed consent, and within one year of diagnosis or had metastatic breast cancer. All were given access to the Internet-based CHER Web site and use of the "Ask an Expert" service for 16-weeks. They were paid to fill out a pre-test and a post-test self-administered survey. After submitting the pre-test, an appointment was scheduled to deliver the computer to the study participant and train her how to use the system. After four months, the participant completed a post-test and returned the computer. In Wisconsin, recruitment began in May 2001 and ended in April 2003. Detroit recruitment began in June 2001 and ended in April 2003.

In total, 1501 women with breast cancer were referred to the study; 332 (22%) of those were eligible; the most common reasons for ineligibility were disqualification of the income criterion and unreachable referrals [28]. Two hundred eighty-six women consented to enroll

in the study (86% recruitment rate) inferring that the present intervention can be reasonably generalized to represent those who were reached. There were 55 women who dropped out, died, or could not be reached during the intervention. Therefore, a total of 231 participants were retained in the program who returned the pre-test and four-month post-test whose surveys were finally analyzed.

4.2. Measures

4.2.1. Use activities—Often patients asked more than one question or expressed different concerns within a single message (Fig. 2), which means from an analytical standpoint there was the potential for multiple purposes and concerns in a single message. Using only the frequency of the sent messages as the unit of analysis to measure the “Ask an Expert” use activity may be inaccurate and underestimate the actual depth and breadth of use. The use activity, therefore, was quantitatively defined as the frequency of distinctive questions or concerns expressed in the messages. As we conducted a content analysis [29], a question was defined as a consulting query, a textual segment that contained specific meaningful purposes in which patients raises distinctive topics to express their concerns or uncertainty about their disease in an attempt to receive a response from an expert. During the content analysis, three types of query purposes were defined to facilitate the coding process of the messages sent to the Ask an Expert service: (1) Seeking advice or an opinion (2) Seeking information, and (3) Other; queries solely expressed sharing information the patient already possessed or expressed appreciation of others. The distinction between type (1) and (2) is that “Seek Advice or an Opinion” requested responses involving experts’ subjective and professional judgments considering patients’ individual situations or personal concerns described inside the messages in order to produce more complete certainty regarding their questions. “Seeking Information” requested an interpretation or explanation of a specific issue with no personal issue stated (Fig. 2). Two coders were trained to categorize messages into identified consulting queries through line-by-line reading from continuous message text. Through a pilot coding process, inter-coder reliability was conducted to test whether the consulting queries were identified reliably between two coders. A comprehensive coding process then was performed, and the lead author called a session with the two coders to work on discrepant consulting messages. These consulting queries served as the basic units of analysis measuring the use activity in this study.

4.2.2. Psychosocial variables—This study examined the relationship among the use activities of the Ask an Expert service and five psychosocial variables. Each psychosocial variable was measured at both the pre-test and post-test surveys by asking a set of items where the response set used a five-point scale ranging from 0 = “Disagree very much/ Never” to 4 = “Agree very much/Always” (see Appendix B for a whole list of items associated with psychosocial variables). Cronbach’s α was measured as a reliability coefficient for each psychosocial variable to determine whether constituent items were measuring the same constructs. In practice, the coefficient is considered reliable when higher than 0.8 [30]. Those psychosocial variables were developed by CHESS and have been used in a number of studies with high reliability.

The Information Seeking scale was a five-item measure (pre-test Cronbach’s α = 0.835, post-test α = 0.853) developed in previous CHESS research [31] to understand a woman’s need for information regarding breast cancer (e.g., “I needed more understandable information about breast cancer”).

Social support was a six-item scale (pre-test α = 0.869, post-test α = 0.863) developed in previous studies [24,32] to assess a woman’s perceptions of emotional and instrumental support (e.g., “There are people I could count on for emotional support”).

Perceived health self-efficacy was a three-item scale (pre-test $\alpha = 0.758$, post-test $\alpha = 0.799$) used to assess a woman's perception of self-efficacy specific in health-related situations (e.g., "I am confident I can have a positive effect on my health"). The measure was developed in previous CHESS studies [31,33] to assess patients' confidence in taking care of their health-related problems [34].

Participation in health care was an eight-item scale (pre-test $\alpha = 0.812$, post-test $\alpha = 0.848$) developed by the CHESS research team [24,31] to measure a woman's perception of involvement in coping with her disease and confidence in dealing with physicians, and making treatment decisions (e.g., "I felt comfortable with how involved I was in my care").

Doctor-patient relationship was a six-item scale (pre-test $\alpha = 0.810$, post-test $\alpha = 0.870$) to measure a woman's appraisal of her relationships with her clinicians (e.g., "I am comfortable discussing my treatment choices with my doctor"), which had been used in a previous study to examine the influence of the doctor-patient relationship when patients use conceptually distinct services of an interactive cancer communication system [17].

4.2.3. Control variables—To examine the main effect of Ask an Expert use, the use of other CHESS services was controlled as covariates during the analysis as all the psychosocial variables were measured from the participants who could access CHESS services. Those psychosocial measurements were considered aggregated and compound effects and the usage of the Ask an Expert service may interact with other CHESS use. For example, part of patients' improvements on the Participation in Health Care scale could have been derived from their access to other CHESS services such as the online support groups (Discussion Group) or interactive breast cancer treatment decision tools. As a result, we cannot say whether other portions of CHESS accounted for these effects. Three usage variables of other CHESS services were statistically controlled as covariates to diminish their effects confounding the analysis: Discussion Group, Information Services, and Interactive Services. Those three variables were measured as the amount of time spent (by minutes) during patients' 16-week study period.

Four demographic variables were used as controls to statistically reduce possible error in making inferences about relationships between the primary independent and dependent variables: age, race/ethnicity (Caucasian/African American/other minorities), whether they lived alone (yes/no), and whether they lived in an urban or rural setting. Because the target group already focused on low-income cancer patients, socioeconomic status was only controlled using the Education Level variable. In addition, two disease-related factors, days between diagnosis and intervention and stage of cancer including early (stages 0, 1, and 2) and late (stages 3, 4, or inflammatory) were included because previous studies suggest both variables were associated with patients' level of psychological adjustment and distress [35,36]. Finally, pre-test levels of the psychosocial variables were also statistically controlled.

4.3. Analytic framework

To examine how use of the Ask an Expert service influenced the psychosocial variables, multiple regression models were formed for each of the psychosocial variables including information seeking, social support, perceived health self-efficacy, participation in health care, and doctor-patient relationship. In each model, the control variables were entered in a regression model along with the pre-test level of each psychosocial variable. The models were repeated with consulting queries as the independent variables and post-test scores as the dependent variables.

5. Results

In total, 231 participants submitted 502 messages to the Ask an Expert service. For women's use activity, 865 units were identified as consulting queries within those messages (mean = 3.74 consulting queries per participant, median = 1, inter-quartile range = 0–3).

The participants had a mean age of 51 years. The majority was Caucasian (61.9%), 35.1% were African-American and 3.0% were other minorities. Education levels were primarily high school degree (31.2%), some college (29.9%), and bachelor's degree (12.1%). About 70% were in the earlier stages of cancer with an average of four months since diagnosis before obtaining access to CHESS. 66.7% of women lived in rural areas and 24.7% lived alone. Zero-order correlation analyses were carried out to examine if any relationship existed between the use activity in terms of the number of consulting queries with age (years), and days since diagnosis (days) variables. No significant correlation was found. *T*-Tests examined if a significant difference of use activity existed on race (Caucasian/non-Caucasian), education, stage of cancer (early/late stage), urban vs. rural residence and live alone (yes/no) variables. No significant correlation was found on these variables either. Among the 55 non-retained participants, the proportion of African-American (68.8%) was significantly higher than those (35.1%) in the retention group.

As shown in Table 1, zero-order correlation analyses were run to determine if there were any significant relationships and the direction of the relationships among the use activity and the psychosocial measurements including pre-test, post-test and change scores. First, the use activity had significant, negative relationships with pre-test scores across all five psychosocial variables: information seeking ($r = -0.219, p < 0.01$), social support ($r = -0.155, p < 0.05$), health self efficacy ($r = -0.163, p < 0.05$), participation in health care ($r = -0.255, p < 0.01$), and doctor-patient relationship ($r = -0.275, p < 0.01$). There was no significant relationship found among the post-test scores except for a positive correlation between using the Ask an Expert service and doctor-patient relationship ($r = -0.134, p < 0.05$). Second, when looking at the use activity correlated with the change scores, significant, positive relationships were found with health self efficacy ($r = 0.187, p < 0.01$), participation in health care ($r = 0.197, p < 0.01$), and doctor-patient relationship ($r = 0.153, p < 0.05$).

To gain a better understanding of how the use activities were associated with the psychosocial variables, three distinct use activity groups were defined (Table 2) based on the frequency of the consulting queries that participants submitted: (1) not engaged group (participants who never submitted any consulting query to the experts, $n = 99$); (2) low engaged group (participants who submitted at least one and less than four consulting queries, $n = 75$), and; (3) highly engaged group (participants who submitted four or more consulting queries, $n = 57$). A one-way ANOVA was carried out to test the similarity among three groups on age (years), education (years), and time since diagnosis (days). The chi-square goodness-of-fit test examined if any significant dependencies existed on the race, stage of cancer, urban vs. rural residence and live alone variables among the three groups. No significant differences were found between those demographic and disease-related variables.

Table 2 shows the mean pre- and post-test scores of five psychosocial variables among the three groups. To understand how psychosocial variables influenced the use of the service, one-way ANOVA tests were also carried out to test the heterogeneity among three groups at pre-test scores. Significant group differences were found in most of the dependent variables on the pre-test scores (except Health Self Efficacy). Following a post hoc analysis (significance level at 0.025 due to two pair-wise contrasts), the highly engaged group had

significantly lower pre-test scores than the not engaged group across most psychosocial variables, indicating that highly engaged participants started with more negative perceptions. The not engaged group always had higher scores in both the pre- and post-tests across five psychosocial variables, indicating that the participants in this group were already better off than those who used the service (Table 2). In order to gain insights about potential effects of using the Ask an Expert service, the following regression analyses only focused on the group of users who had submitted one or more consulting queries (low engaged and highly engaged groups).

Table 3 summarizes the main effects of using the “Ask an Expert” service among our psychosocial variables of interest. Five hierarchical regression models were run with the post-test scores of the psychosocial dimensions as dependent variables, respectively, and use activity as an independent variable after controlling for demographic and health-related variables as well as corresponding pre-test scores of the dependent variables. As shown in Table 3, significant main effects were found on the Health Self Efficacy ($b = 0.199, p < 0.05$), Participation in Health Care ($b = 0.216, p < 0.05$) and Doctor–Patient Relationship ($b = 0.180, p < 0.05$) regression models. As expected, each of the pre-test scores of the dependent variables had a strong relationship with the post-test scores. The patterns found in the regression analyses were consistent with those from zero-order correlations among use activity and change scores of the psychosocial variables (see Table 1).

6. Discussion

The results support the premise that online health consultation appears to serve as a helpful tool for some patients to seek additional information about their cancer and associated treatments beyond that provided by their clinicians [11–14,16]. This study examined five research questions regarding how the use of online consultation was associated with five psychosocial health-related variables including information seeking, social support, health self efficacy, participation in health care, and doctor–patient relationship. To answer those research questions, first we examined how those psychosocial perceptions were associated with subsequent use of the service. The correlation tests (Table 1) showed that participants who had more negative perceptions at pre-test tended to engage more in using the Ask an Expert service. The finding suggests that those patients with greater perceived needs are more likely to seek detailed information from an online cancer expert [37], which could be related to their lack of satisfaction with the amount of information they had received [38]. Patients with less confidence and satisfaction in making decisions or those who feel less in control over their situation may seek more mentoring, sharing, discussion and encouragement from online health specialists with greater autonomy.

On the other hand, to determine how the use of the service could possibly influence patients' psychosocial outcomes, this study investigated the main effects of using the Ask an Expert service on various psychosocial measures (Table 3). The results showed that using the Ask an Expert service was significantly associated with improvements in patients' perceptions of health self-efficacy and participation in health care indicating that through the health consultation service, patients feel more empowered to manage their disease and are more satisfied with their involvement in the treatment or management plan [39]. A main effect was also found related to the improvement of patients' appraisal in their doctor–patient relationship. By obtaining additional information or reassurance about the recommended treatment, patients may be encouraged to bring up and discuss those findings with their doctors, and feel more comfortable about their shared treatment decisions [19]. Some research argued that patients' online activities may run the risk of harming the relationships with their doctors due to patients' limited capacity to evaluate the quality of information and professional affiliations of online providers [16]. The risk of possible impairment of doctor–

patient relationship caused by using the consultation service was not found in our study. No significant main effect was found on patients' perceptions of need for information seeking and perception of social support. It is possible that given the access to various information and communication services in CHESS system, patients' perceptions could be confounded by effects from those services.

Some studies have investigated patients' motivations and reasons for using online health consultation services, which indicate that the purposes of choosing to communicate with online experts are to seek health information, medical advice, or decision support [40,41] and the reasons are due to convenience or anonymity [42]. Some studies tried to reveal the content of the queries that patients asked and classified the queries into different categories to prioritize the topics patient addressed [40,43]. However, the above studies did not examine how use activity is associated with psychosocial measurements.

Examination of the not engaged group, representing 43% of the participants, found that the Ask an Expert service attracted a little more than half of participants who had access to it. The non-engaged patients in this group always started out and ended off with higher scores across seven psychosocial variables (Table 2) suggesting that the not engaged participants already had access to other resources or were simply better off in general and did not need the service. When comparing the proportions of the highly engaged participants of the Ask an Expert service to participation of those using another CHESS communication service called Discussion Group which enables peer-to-peer information sharing and support among patients [32,44], the findings showed that the percentage of participants in the highly engaged group (submitted four or more queries) accounted for 25% of all participants was relatively lower than the one in the "active group" of Discussion Group service accounted for 46% of the all participants, suggesting the participants were more interested in communication with peers than online experts when using CHESS services. The highly engaged participants always started off worse in the pre-test scores compared to the not engaged group. By engaging actively, the gaps that existed at the pre-test among the not engaged and highly engaged participants narrowed. Use of online health consultation appeared to level the differences, narrowing the gaps between those who were worse and better off at pre-test (Fig. 3).

This was a retrospective study using an existing data source that had been collected for another purpose, examining the feasibility of reaching underserved women with breast cancer and determine how they used the entire CHESS system and what impact it had on them [28,31]. Adding to the previous CHESS research emphasizing the generic usage of the system, this study primarily focused on the use of an online consultation tool (Ask an Expert). Distinct from the measurement of time spent using CHESS services in previous research, this study looked closely at the number of conceptually distinct queries within participants' messages and assumed these granular queries more accurately represented the actual engagement of the service.

In addition, the psychosocial variables were considered aggregated and compound effects possibly from multiple CHESS services. In this study, we statistically controlled other CHESS use to minimize the confounding effects. Further research should also consider a study design that limits study participants access to the Ask an Expert service only, eliminating access to other information seeking, support and decision-making tools provided in CHESS, which could more accurately reflect the specific contribution of the online consultation service. With the limited psychosocial measurements available in this study, other potentially valuable variables would have been interesting to examine such as the perceived usefulness of Experts' responses, relationships with the experts, the usability of the interface, or satisfaction with the service. This study could be improved by including

other relevant questions related to using the Ask an Expert service in the study design. For example, when one patient receives a response from the Expert, a quick feedback box could pop up in the application to let the patient evaluate the quality of the answer or their satisfaction with the response.

Another limitation of using the available data set in this study was that participants were recruited and used Ask an Expert service from 2001 to 2003. Since that time, other online applications or search engine technologies have been developed to provide patients information and support to cope with their illnesses. However, the results of this study still provide valuable insights in today's Internet environment. In fact, most online consultation with experts or clinicians (whether as part of electronic health records or email) still occurs via asynchronous text messaging because it is convenient to use when patients and clinicians have time to do so. On the other hand, patients may be more computer savvy today compared to when this study was conducted as well as more familiar with using the Internet as a resource to cope with health crises. Since significant relationships were found between using the service and the psychosocial outcomes in this study, the results validate the potential usefulness of online consultation tools and are worthwhile in the consideration of promoting the online consultation tool as a supplementary source to help patients to cope with their diseases. Future research should examine whether or how the usage and utilization of the online consultation may have changed in the today's Internet climate and compare these results to other ways patients might participate in online health consultation. The analytical scheme in this study could also provide guidance for future evaluations of online communication services.

In considering the generalizability of the results, this study focused on a population of low-income women with breast cancer. It would be worthwhile to conduct a similar study design on breast cancer patients with different socioeconomic characteristics or people coping with other illnesses. The research, for example, could recruit male patients with prostate cancer using the online consultation service and compare the results with the current study to explore the possible different use behaviors or impacts between female and male patients facing different health challenges.

Future studies should also focus on the low engaged group to identify the possible barriers that prevent them from more fully engaging with the online consultation service, or the reasons that they quit after brief access to the service. For example, patients may feel uncomfortable or insecure about talking with an unknown online consultant or maybe they just do not need it. Finding out why this group did not engage more actively could help developers make improvements to these services and potentially increase the online consultation activity and associated outcomes.

Finally, a cancer diagnosis often leads patients to seek additional information on a range of health issues with their situation and make appropriate treatment decisions [2]. In this regard, online health consultation appears to provide a valuable opportunity for low-income patients with breast cancer to seek supplementary information regarding their diseases and treatment options in respect and response to their individual needs, preferences, and situation. Results of these analyses indicate that through using this tool, some patients will feel more confident and empowered to actively participate in their health care, perceive greater involvement in coping with their illness and have a more positive appraisal of the relationship they have with their doctors. This study not only expands understanding about the process and potential benefits of online health consultation, but also provides some guidance for developing more effective Web-based medical communication system to help low-income, breast cancer patients cope more effectively with their illness.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi: 10.1016/j.ijmedinf.2011.03.011.

Summary table**What was already known on the topic?**

- The Internet-based interactive communication systems have revolutionized the way patients access medical information, understand their conditions, and make health treatment decisions
- Online health consultation serves as an alternative source of medical information enabling cancer patients to query, interact, and communicate online with health specialists for coping with their illness beyond that provided by their current clinical providers

What this study added to our knowledge?

- Patients with greater perceived needs, less participation in their health care or less control over their situation may seek more consultation from online health specialists with greater autonomy.
- Use of online health consultation appears to level the differences, narrowing the gaps between those who were worse and better off.
- Through using this tool, some low-income patients with breast cancer will feel more confident and empowered to actively participate in their health care, perceive greater involvement in coping with their illness, and have a more positive appraisal of the relationship they have with their doctors.

Fig. 1. CHES Ask an Expert interface (user could click on 'Ask a Question' button to edit and send questions, and click on 'Read Answers' button to read responses).

Fig. 2.

Consulting queries (this message contained two purposes: the upper consulting query requested an explanation of a specific interest and the lower one requested advice from the expert).

Fig. 3.

Not-&-highly engaged groups at pre-&-post test scores on Health Self-Efficacy variables (two-way ANOVA was carried out to test the interaction between not-&-highly engaged and pre-&-post test on Health Self-Efficacy scores. The interaction effect ' F ' was 2.61 with marginal significant level 0.069).

Table 1

Zero-order correlations among use activity and psychosocial variables.

	Use activity zero-order correlation against		
	Pre-test scores	Post-test scores	Change scores
Information seeking ^c	-0.219 **	-0.106	0.071
Social support	-0.155 *	-0.059	0.114
Health self efficacy	-0.163 *	0.032	0.187 **
Participation in health care	-0.255 **	-0.092	0.197 **
Doctor-patient relationship	-0.275 **	-0.134 *	0.153 *

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

^c The scores have been converted to a reversed direction.

Table 2

Mean scores of psychosocial variables among groups.

	Mean scores			One-way ANOVA F^b
	Not engaged $n = 99$ (43%)	Low engaged $n = 75$ (32%)	Highly engaged $n = 57$ (25%)	
Need for information seeking ^a				
Pre	1.27	1.06	0.85	5.99 **
Post	2.15	1.87	1.93	2.13
Social Support				
Pre	3.11	2.83	2.82	3.24 *
Post	3.17	2.97	3.08	1.44
Perceived health self-efficacy				
Pre	2.94	2.83	2.68	2.36
Post	3.13	2.90	3.14	3.18 *
Participation in health care				
Pre	3.17	2.98	2.88	5.84 **
Post	3.37	3.10	3.19	5.48 **
Doctor–patient relationship				
Pre	3.14	2.98	2.88	3.56 *
Post	3.39	3.07	3.18	6.51 **

^aThe scores have been transferred to reversed direction.^bOne-way ANOVA significant p values.*
 $p < 0.05$.**
 $p < 0.01$.

Table 3

Regression analyses predicting psychosocial variables (post-test): main effect^a.

	Predictors (psychosocial variables at post-test)				
	Information seeking	Social support	Health self efficacy	Participation in health care	Doctor–patient relationship
Control variable					
Age	−0.089	−0.048	−0.004	−0.087	−0.091
Ethnicity	−0.226**	0.053	0.059	−0.047	−0.034
Early or late stage	−0.275**	0.021	−0.068	−0.072	−0.125
Days between diagnosis and intervention	0.013	0.168*	0.020	0.020	0.005
Live alone	0.098	0.141	0.080	0.015	0.090
Education	0.183*	0.159*	0.138	0.071	0.039
Discussion group	−0.122	−0.130	−0.077	−0.108	−0.089
Information service	0.283**	0.083	0.117	0.202*	0.212*
Interactive service	−0.180	0.031	0.112	0.041	−0.002
Information seeking (pre-test)	0.197*	−	−	−	−
Social support (pre-test)	−	0.672**	−	−	−
Health self efficacy (pre-test)	−	−	0.441**	−	−
Participation in health care (pre-test)	−	−	−	0.582**	−
Doctor–patient relationship (pre-test)	−	−	−	−	0.536**
R2 change (%)	24.8**	47.0**	26.5**	39.9**	34.7**
Main effect					
Ask an expert use activity ^c	0.078	0.093	0.199*	0.216*	0.180*
R2 change (%)	0.2	0.4	2.7*	3.2*	2.2*

^a Cell entries refer to the standardized regression coefficient.

^c Log transferred due to the positive sleekness of the distribution.

* $p < 0.05$.

** $p < 0.01$.