

The process and effect of supportive message expression and reception in online breast cancer support groups

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Abstract

Objective: To better understand the process and effect of social support exchanges within computer-mediated social support (CMSS) groups for breast cancer patients, this study examines (1) the dynamic interplay between emotional support giving and receiving and (2) the relative effects of emotional support giving and receiving on patients' psychosocial health outcomes.

Methods: Data was collected from 177 patients who participated in online cancer support groups within the Comprehensive Health Enhancement Support System (CHESS) during the 4-month intervention. Data included (1) pretest and/or post-test survey scores of demographic, disease-related, and psychosocial factors, (2) automatically collected CHESS usage data, and (3) computer-aided content analysis of social support messages posts.

Results: Hierarchical regression analyses revealed that those who receive higher levels of support from others have fewer breast cancer-related concerns ($\beta = -0.15, p < 0.05$), while those who give higher levels of support to others reframe their own problems in a positive light and adopt more positive strategies for coping ($\beta = 0.16, p < 0.05$). In addition to these positive effects, partial correlation analysis indicated that these two supportive behaviors are reciprocal.

Conclusions: We concluded that supportive exchanges of receiving and giving play positive, but different, roles in predicting psychosocial health outcomes. Moreover, emotional support giving and receiving tend to reinforce each other. Our findings help practitioners, health-care providers, and health system designers make sense of diverse social support processes among cancer patients participating within CMSS groups.

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Keywords: social support giving; social support receiving; reciprocity; computer-mediated social support (CMSS) group; comprehensive health enhancement support system (CHESS); interactive health communication system (IHCS)

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Being diagnosed with breast cancer and undergoing various treatments is a traumatic event for cancer patients [1]. They often experience many anxieties and uncertainties about the prognosis of their illness, thus their needs for support are likely to be high and vary during the course of their cancer experience. For breast cancer patients, one common way to cope with these problems is to engage in social support groups. Indeed, many scholars argue that social support exchange could function as an effective means to empower patients, enhancing their control over their illness, and managing uncertainty about their situation, which, in turn, leads to improved physical and emotional well-being [2–4].

Similar to the beneficial effects of traditional face-to-face social support, computer-mediated

social support (CMSS) can be offered as a functional alternative for people with chronic illness [5–8]. In recent years, this phenomenon has increased because the growth and prevalence of the Internet has increased the accessibility and use of information and support for people with serious illnesses. Such trends are consistent with the growing recognition that, rather than being passive recipients, patients actively engage in mediated information and support seeking to help them effectively cope and make informed decisions during the course of their illness [9]. Recent studies found that participating in CMSS groups has emerged as an important source to seek and receive social support during social interaction, which ultimately yields positive effects on health outcomes [10–16].

A review of literature also suggests that it is important to differentiate the two behavioral exchanges of giving and receiving social support in order to uncover how supportive messages are exchanged [14,17,18]. For example, one recent study found that those who have more resources at pretest are more likely to provide emotional support to others, while those who lack resources are more likely to seek and receive emotional support from peer patients to compensate for deficits in their social network [19]. Unfortunately, little is known about how different modes of engaging in supportive exchanges—the reception and provision of emotional support—might matter for breast cancer patients' psychosocial health outcomes. Accordingly, this study will simultaneously take these two supportive behaviors of giving and receiving into account in explaining their relative effects on psychosocial adjustments for breast cancer patients in the context of online support groups. In addition, this study will further examine the dynamic interplay of support giving and receiving among breast cancer patients within CMSS groups. Our aim here is to provide insights into the underlying mechanisms of what makes CMSS groups effective and how patients facing life-threatening illnesses interact and obtain benefits from such systems.

Literature review

Defining and measuring supportive communication behaviors

Our conceptual definition of supportive communication is defined in behavioral terms [20,21] rather than in the individuals' perception that an individual is 'loved, valued, and able to count on others should the need arise' [22]. We adopt a communicative perspective, which defines social support as 'verbal and nonverbal behavior that influences how providers and recipients view themselves, their situations, the other, and their relationship and is the principal process through which individuals coordinate their actions in support-seeking and support-giving encounters' [23]. In this view, supportive behavior is reflected in the exchange of supportive messages and conversations of advice, aid, and affect, which typically involves interactive communication processes [24,25]. With this in mind, several scholars argue that the notion of social support is multidimensional and identifies diverse dimensions, which include informational, emotional, and instrumental support and so on [24,26]. Among these varied types of social support, however, we focused primarily on emotional support, since this has yielded reliably positive and strong effects on health outcomes in past research [4,27].

Along with this conceptual definition of social support, one critical concern in the social support literature is its varied measurements across social support studies. Studies utilizing the self-reported perceived availability of support measures are dominant in most past studies. This is due to the fact that the enacted social support, which often refers to 'the things relational partners do and say with the intention of helping one another manage problems and stress' [28] in observational behavioral data, is difficult to obtain due to the enormous time and high cost of data collection. We believe, however, that this observed measure of social support in which the actual support is enacted may yield some benefits by (1) illustrating the natural dynamics of social interactions, and (2) adding to the ecological validity of our study. The present study, therefore, will provide novel ways of measuring social support behaviors by utilizing the observed supportive exchanges in actual support group discussions.

Effects of supportive communication on health outcomes

In a review of the social support literature, there are two common types of supportive behaviors in the actual social interaction: the act of reception and provision of social support. For example, Burleson and MacGeorge claim that 'supportive communication is a venue for exploring fundamental communication process, including message production, message reception, and conversational interaction' [24]. Moreover, the act of providing and receiving social support can be applied to computer-mediated communication with two different communication attributes. Providing support could be conceived of as the act of writing supportive messages (i.e. expression), while receiving support is the act of reading those messages (i.e. reception) during online discussion [14]. Along with these distinct supportive communication behaviors, several studies have shown that supportive communication behaviors contribute to positive health-related outcomes, and they can be classified into either recipients' or providers' perspectives.

More specifically, social support is thought to increase patients' quality of life by alleviating the harmful effects of stressful experiences or emotional distress, assuring feelings of comfort or a sense of being cared for by others, and helping patients to cope effectively and improve their physiological health [2,29–31]. All of these positive effects, however, were drawn from mostly the recipients' perspectives of social support. In particular, past research suggests that those who receive emotional social support may experience a general reduction in uncertainty about their illness and increase self-esteem through the processes of social comparison and emotional validation [18,32].

Although relatively little research has examined the role of providing social support in health outcomes, recent research has shown an increased interest in taking into account the effect of the provision of social support along with the reception of it [33]. More specifically, the helper therapy principle argues that those who give social support to others are involved in the act of self-persuasion while they persuade or inform others [34]. This, in turn, empowers perceived control and increases their sense of self-esteem and personal strength [35]. In this process, they also engage in self-reflection by reappraising their own problems objectively and ultimately learn new coping skills and shift perspectives to a more positive light, which in turn leads to a reduction in levels of emotional distress [36–38]. Similar to the effect of the reception of social support, these arguments also suggest that the provision of social support could yield beneficial effects on health outcomes.

On the basis of these considerations, we argue that both giving and receiving emotional support will have positive effects on psychosocial health outcomes. This line of reasoning offers two sets of hypotheses concerning the effects of emotional support giving and receiving on breast cancer concerns, positive reframing, and emotional well-being:

H1a: Emotional support giving within CMSS groups will be associated with fewer breast cancer concerns.

H1b: Emotional support receiving within CMSS groups will be associated with fewer breast cancer concerns.

H2a: Emotional support giving within CMSS groups will be positively associated with positive reframing.

H2b: Emotional support receiving within CMSS groups will be positively associated with positive reframing.

H3a: Emotional support giving within CMSS groups will be positively associated with emotional well-being.

H3b: Emotional support receiving within CMSS groups will be positively associated with emotional well-being.

The reciprocal process of social support giving and receiving

In addition to considering separately the reception and provision of emotional support behaviors on psychosocial health outcomes, we will also further examine the dynamic interplay between these two behaviors among breast cancer patients within CMSS groups. Several scholars suggest that reciprocity diffuses in social interactions such as peer relations and group interactions [39–42]. For example, as Gouldner states, ‘the norm of reciprocity holds that people should help those who help them and, therefore, those whom you have helped

have an obligation to help you’ [43]. From this line of reasoning, reciprocity can also serve as the essential element to guide the social interactions and maintain stable relationships among members/patients in our CMSS group. Thus, it would be interesting to consider this ‘microdynamics of the interactive support transactions or interaction’ [44] as an additional behavioral outcome in order to better understand the nature of the social support process.

The notion of the reciprocity in social support suggests that beneficial outcomes of being involved in a social support network are influenced not only by support reception but also by support provision. Moreover, it provides a plausible explanation of underlying dynamics between support reception and provision. In particular, studies of social support have emphasized that the norm of reciprocity as an underlying mechanism of social support provision [31,45]. Based on social exchange theory [46] and equity theory [47], previous literature has suggested that people in a social support network have expectations for a reward or a motivation to maintain an equilibrium of social transaction [42]. Because a violation of such expectation or imbalance resulted from failure to reciprocate may cause emotional and psychological distress (i.e. guilt, discomfort, indebtedness and inadequacy), overbenefiting makes social interaction uncomfortable [48]. In contrast, those who have the ability or opportunity to reciprocate benefit from others have positive feelings of self-esteem, pride, and life satisfaction [14,49]. The norm of reciprocity contributes to the well-being of people in mutually beneficial relations and promotes their getting involved in the virtuous circle of support provision [31,50].

Despite the important role reciprocity plays within the social support process, there is a relative dearth of empirical evidence concerning the reciprocal links between emotional social support received and given in specific relationships of breast cancer patients. Thus, we pose the following research question:

RQ: What is the relationship between social support giving and receiving?

Methods

Participants

The CMSS groups examined in this study were a part of the Comprehensive Health Enhancement Support System (CHESS), which is an Internet-based health-care system that provides patients and their families with a range of conceptually distinct services [51]. CMSS groups within CHESS are text-based, asynchronous bulletin boards that allow users to anonymously share information and support.

The discussion group use and survey data were collected as a part of a larger Digital Divide Pilot Project of the CHESS 'Living with Breast Cancer' program, where underserved women with breast cancer in rural Wisconsin and Detroit, Michigan were given access to CHESS [52]. Eligibility criteria required that participants were at or below 250% of the federal poverty level, not homeless, within 1 year of diagnosis with early-stage breast cancer or within 1 year of a diagnosis of metastatic breast cancer, and able to read and understand an informed consent letter.

Of the 341 eligible patients initially recruited, 286 joined the study and 55 declined. After submitting their pretest, all study participants were loaned a computer and given Internet access for 4 months. Of the 231 participants who completed the pretest survey, 177 women were active participants who either wrote or read at least one message in the CMSS groups. Thus, 177 participants were included in the subsequent analyses. In order to compare if those who retained in our analysis ($N = 177$) were different from those who did not ($N = 54$) in terms of their baseline scores (i.e. demographics, disease-related factors, pretest value of outcome variable), we performed both t -test and chi-square test. The results revealed that our study sample had more Caucasians and a higher level of education than those who are excluded from the analysis ($\chi^2 = 62.612, p < 0.001$; $|t| = 2.244, p < 0.05$, respectively).

Procedures

First, examination of emotional support messages within the CMSS groups was accomplished through the use of the InfoTrend computer-aided content coding system, which has been found to be a flexible and precise computer-aided content analytic system that codes for key ideas and idea combinations through the implementation of a dynamic rule structure [53,54]. The analyst creates the rules for the system that identify (a) idea categories, (b) words that tap or reveal those idea categories, and (c) rules that allow pairs of ideas in the text to be combined to form more complex meanings. These rules are then tested iteratively against actual textual content. Once a high level of consistency is achieved between the human programmers' 'reading' and the computer software's 'coding' of a sample of the content, then all textual content is coded with the assistance of the computer. Consistent with writing norms, a discrete message post was the unit of analysis.

We employed the InfoTrend system to analyze the content of the 19 695 message posts produced by participants during the study period. Through the iterative process described above, (1) expressions of empathy and understanding and (2) statements of offering support were measured along with other

categories. Owing to high correlation between these two categories (0.92 for writing, 0.98 for reading), we combined them to represent the emotional support construct. It was coded to capture the following types of statements as they occur in natural language: 'I'm so sorry for you,' 'Sorry to hear about...,' 'My heart goes out to you,' 'You have my sympathy,' 'Glad to learn that...,' 'I know this has been a hard time for you,' 'You can get through it,' 'You hang in there,' 'We're here for you,' and many other phrases. Reliability estimates conducted on a subset of 200 discussion posts between human and computer coding produced an estimate of 91% agreement across these different categories. This was a conservative test, as an entry was coded as a disagreement if any aspect of it was misidentified by the computer. On this basis, Scott's Pi was calculated by comparing the percent expected agreement by chance across the seven coded categories with the actual agreement. It was determined to be 87.5% greater than by chance indicating a highly reliable coding system.

Next, we integrated the emotional support message coding with action log data, which automatically tracks the message as a chain of expression and reception interactions on an individual keystroke level. This action log data enabled us to track which participant wrote and/or read which messages and when. Finally, this action-level, content-coded data is combined with survey data to examine how emotional support giving and receiving relate to psychosocial health outcomes for patients.

Measures

Dependent variables

This study employed positive reframing, breast cancer-related concerns, and emotional well-being as primary psychosocial health outcome measures. Positive reframing ($M = 2.86, SD = 0.95$, inter-item correlation = 0.59, Cronbach's $\alpha = 0.74$ at pretest; $M = 2.95, SD = 0.94$, inter-item correlation = 0.62, Cronbach's $\alpha = 0.77$ at post-test) originated from the Brief Coping [55] as one of the strategies for coping with breast cancer. It was measured on a 4-point scale ranging from 1 (I haven't been doing this at all) to 4 (I've been doing this a lot), using two items about how patients have tried to deal with stress in the past 2 weeks: (1) I've been trying to see breast cancer in a different light, to make it seem more positive, and (2) I've been looking for something good in what is happening.

Breast cancer-related concerns ($M = 1.76, SD = 0.89$, Cronbach's $\alpha = 0.66$ at pretest; $M = 1.51, SD = 0.78$, Cronbach's $\alpha = 0.64$ at post-test) is one of the most widely used scales for cancer patients' quality of life as it addresses breast cancer patients' emotional, physical, and body image concerns and distress related to treatments and side effects

[13,52,56,57]. It was assessed on a 5-point scale ranging from 0 (not at all) to 4 (extremely), using seven items about how much patients have experienced certain things in the last 4 weeks for each of the following: (1) they were self-conscious about the way they dress, (2) they were bothered by swollen or tender arms, (3) they worried about the risk of cancer in other family members, (4) they worried about the effect of stress on their illness, (5) their change in weight bothered them, (6) Their hair loss bothered them, and (7) Their skin bothered them as a result of radiation treatment.

Emotional well-being ($M = 2.40$, $SD = 1.00$, Cronbach's $\alpha = 0.87$ at pretest; $M = 2.82$, $SD = 0.83$, Cronbach's $\alpha = 0.85$ at post-test) is one of the subdimensions of the Functional Assessment of Cancer Therapy Breast [56]. It was assessed on a 5-point scale ranging from 0 (not at all) to 4 (extremely), using six items about how often participants had felt each of the following in the last 4 weeks: (1) I feel sad (reversed), (2) I feel like my life is a failure (reversed), (3) I feel nervous (reversed), (4) I am worried about dying (reversed), (5) I feel like everything is an effort (reversed), (6) I am worried that my illness will get worse (reversed).

Independent variables

Our independent variables are emotional support giving and receiving ($M = 0.12$, $SD = 0.18$, Minimum = 0, Maximum = 0.80 for support giving per participant over the entire 4 months; $M = 0.33$, $SD = 0.32$, Minimum = 0, Maximum = 3.04 for support receiving per participant over the entire 4 months; $M = 15.08$, $SD = 43.10$, Minimum = 0, Maximum = 470 for total posting; $M = 269.60$, $SD = 548.95$, Minimum = 0, Maximum = 3905 for total reading). Emotional support giving was measured by the total count of emotional support categories posted divided by the total number of messages posted. Likewise, emotional support receiving was measured by the total count of emotional support categories read divided by the total number of messages read. Note that this study uses a measure of proportion rather than a raw count. This approach makes more sense than simply using raw scores because people differ in how much they read or write. It also rules out the potential confounding effect of writing/reading other types of supportive content in the message (such as informational or tangible support) [13,14,19,58,59]. Thus, the percentage here reflects writing/reading more or less within a specific content category (i.e. emotional support) rather than the overall number of messages written/read would predict by themselves. As the distribution of our measures of support exchanges was highly positively skewed, we conducted log transformations for our independent variables of emotional

support giving and receiving and used them for subsequent analyses.

Control variables

In order to avoid any biased estimates of emotional social support on our outcomes, our analyses included several factors as controls, which can have some influences in predicting the relationship between supportive behaviors and psychosocial health outcomes [33]. Demographic factors include age, ethnicity (African American = 0 and Caucasian = 1), education, and living situation (live alone = 1 and live with others = 0). The disease-related factor classified patients by their stage of cancer: patients at stages 0, I, or II were coded as early (coded 0) and those at stages III, IV, or inflammatory were coded as late (coded 1).

Analytic framework

To test the effects of social support giving and receiving on our dependent variables, a series of hierarchical regression analyses were conducted. To do so, several control variables as measured at baseline were entered in blocks to examine their relative explanatory power, including pretest level dependent variables, socio-demographics and cancer disease variable. These control variables were followed by main effect variables of social support giving and receiving.

In addition, to explore the question of whether the giving of emotional support is similar across different conditions to the receiving of emotional support, we performed a chi-square test by converting the continuous measure of emotional social support into the recoded measure of giving and receiving of emotional social support (i.e. 0 = no, 1 = yes). As a more stringent test of reciprocity inquiry, partial correlation analysis was used after controlling for socio-demographic factors, disease-related factor, and total number of posting and reading during discussion group use.

Results

Descriptive statistics

As seen in Table 1, the participants in the current study had a mean age of 51.37 years and educational backgrounds with about 31.1 % having a high school degree and about 30.5 % having at least an associate or technical college degree. The racial characteristics of the sample were 76.3% Caucasian and 23.7% African American. 26.6% participants lived alone, whereas 73.4% participants lived with others. 68.4% of women had early-stage cancer, while 31.6 % of women had late-stage cancer.

Predicting breast cancer-related concerns

As shown in Table 2, our regression model accounted for a total of 42.2% of variance when predicting breast cancer-related concerns. Breast cancer-related concerns measured at the pretest was a strong predictor of the corresponding 4-month outcome ($\beta = 0.57$, $p < 0.001$). Among socio-demographic variables, age remained significant in the final model, with younger patients having more breast cancer-related concerns ($\beta = -0.22$, $p < 0.01$). In addition, living situation was positively related to breast cancer-related concerns, implying that those who live alone were more likely to have higher levels of breast

cancer-related concerns ($\beta = 0.16$, $p < 0.05$). As for the main effect variables, as predicted in H1b, social support receiving was significantly negatively related to breast cancer-related concerns, indicating that those who receive higher levels of emotional support from others were more likely to have fewer breast cancer-related concerns ($\beta = -0.15$, $p < 0.05$). However, H1a, which stated emotional support giving will be associated with fewer breast cancer concerns, was not supported.

Predicting positive reframing

As shown in Table 2, the regression model predicting positive reframing performed well, accounting for a total of 32.5% of the variance. Similar to the previous result, positive reframing measured at the pretest was a strong predictor of the corresponding 4-month outcome ($\beta = 0.50$, $p < 0.001$). Among control variables, none were significant. As for the main effect variables, as expected from our H2a, social support giving was significantly positively related to positive reframing, suggesting that those who give higher levels of emotional support to others were more likely to reframe their own problems in a positive light ($\beta = 0.16$, $p < 0.05$). H2b stated that emotional support receiving would be positively associated with positive reframing, but it was not supported.

Predicting emotional well-being

Our regression model accounted for a total of 44.9% of variance when predicting emotional well-being (Table 2). Among predictors, only emotional well-being measured at pretest was a significant predictor of the corresponding 4-month outcome

Table 1. Demographic characteristics

	Participants (N = 177)
Age	
Mean (SD)	51.37 (11.82)
Ethnicity	
Caucasian	135 (76.3%)
African American	42 (23.7%)
Education	
Some junior high	1 (0.6%)
Some high school	13 (7.3%)
High school degree	55 (31.1%)
Some college	54 (30.5%)
Associate or technical degree	25 (14.1%)
Bachelor's degree	23 (13%)
Graduate degree	6 (3.4%)
Live alone	
Yes	47 (26.6%)
No	130 (73.4%)
Stage of cancer	
Early stage (stage 0,1,2)	121 (68.4%)
Late stage (3,4, or inflammatory)	56 (31.6%)

Table 2. Hierarchical regression analyses predicting hypothesized outcome variables

Criterion variable	Breast cancer-related concerns (post-test)	Positive reframing (post-test)	Emotional well-being (post-test)
<i>Block 1: Control Variables</i>			
Breast cancer concerns (pretest)	0.57***	—	—
Positive reframing (pretest)	—	0.50***	—
Emotional well-being (pretest)	—	—	0.66***
Incremental R ² (%)	34.4	29.1	41.1
<i>Block 2: Socio-Demographics and Cancer Disease Variable</i>			
Age	-0.22**	0.01	0.04
Ethnicity	-0.01	-0.01	-0.02
Education	0.07	0.01	0.10
Live alone (Yes = 1)	0.16*	-0.05	-0.12
Stage of cancer (late = 1)	0.06	0.04	-0.06
Incremental R ² (%)	5.7	0.4	3.1
<i>Block 3: Main Effect</i>			
Social support giving	0.02	0.16*	-0.09
Social support receiving	-0.15*	-0.08	-0.01
Incremental R ² (%)	2.1	3.1	0.7
Total R ² (%)	42.2	32.5	44.9

Note: Cell entries refer to the final standardized regression coefficient. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Two-tailed; Listwise deletion; N = 139–146 for Breast Cancer Concerns; N = 138–145 for positive reframing; N = 138–146 for emotional well-being.

($\beta = 0.66, p < 0.001$). Therefore, H3a and H3b were not supported.

Reciprocal relationship between reception and provision of emotional support

Our descriptive analysis reveals that those who received emotional support are more likely to provide emotional support ($\chi^2 = 23.94, p < 0.01$). Among 177 patients, there were 68 patients who both received and provided emotional support from/to other patients. Among those who had not received emotional support, there were no patients who provided emotional support to others. Furthermore, there were 33 patients who neither received nor provided emotional support from/to other patients. Furthermore, a more rigorous test of partial correlation was used. A significant partial correlation between reception and provision of emotional support, after controlling for socio-demographics, cancer disease variable, and total number of posting and reading, was found ($r = 0.27, p < 0.001$). Taken together, these results suggest that emotional support giving and receiving among cancer patients is reciprocal.

Discussion

In the present study, we demonstrated the relative contributions of both emotional support giving and receiving on positive psychosocial health outcomes in the context of coping with a life-threatening cancer experience. More specifically, our analysis revealed that those who receive higher levels of support from others have fewer breast cancer-related concerns, while those who give higher levels of support to others reframe their own problems in a positive light or adopt positive strategies for coping. We also found that social support is a reciprocal process that occurs in socially constructed networks of online breast cancer support groups. Taken together, these results can imply that social supportive exchanges represent a virtuous circle or 'beneficent cycle of mutual reinforcement' [43] for both providers and receivers in which prosocial effects of supportive interaction can flow from the provider to the recipient and vice versa among group members.

Given increased interest about the role of the Internet in health communication [60], this study systematically examined the important roles of supportive communication within computer-mediated support groups on psychosocial health outcomes. Our findings provide support for the hypotheses that emotional support giving and receiving are both important, and these two generate salutary, but unique effects for women facing a life-threatening illness. As for the support giving, our finding is consistent with past research, which has found that translating the event into

language can help cancer patients gain better understanding and cope more effectively with their distress [61,62]. Equally interesting is the finding that support receiving also plays a crucial role in attaining optimal benefits for these women in terms of a reduction in cancer concerns. In line with previous research, consuming messages containing understanding and emotional support may help people learn about many different perspectives related to a given problem. This may also help patients feel less isolated and increase their understanding about the illness and treatment processes, thus reducing the worry and distress that is often part of living with a cancer diagnosis [63]. However, it should be noted that emotional support exchanges did not improve emotional well-being. It can be interpreted that breast cancer concerns and emotional well-being seem to be significantly related ($r = -0.50, p < 0.001$), but they can be different. In particular, previous research suggested that thoughts related to a health threat and the emotional reactions that accompany these thoughts can be different [64]. Our finding is in line with previous research that found patient's breast cancer concerns may be an intermediate outcome, which can lead to patients' emotional well-being as a function of emotional support exchanges [65].

This study also sheds some light on the social support literature by employing the enacted social support measure through computer-aided content analysis of messages written in CMSS groups. From a communication perspective, the use of the enacted social support measure verified the important roles of two communication attributes on beneficial health outcomes: (1) writing supportive messages (i.e. emotional support given), and (2) reading (i.e. emotional support received). This distinction is more plausible in the context of online social support groups than in face-to-face interactions where the two behaviors usually go hand in hand. For example, it is not obtrusive to 'lurk' during a discussion on the Internet, but it may be more awkward in a face-to-face discussion [66,67]. Writing activity on the Internet may lead to optimal benefits on health outcomes for people with breast cancer when compared with face-to-face discussion in that one has more time to think about her responses to others' posted messages and to articulate their desired message, which can foster a more self-reflective or elaborative process [8]. As for the reading attribute, however, we must also acknowledge that this does not allow us to discern whether a patient skimmed through the message or whether she processed its content in a thorough manner. In other words, opening a message does not necessarily translate into a person reading the message and fully processing its content. Future studies should validate our measure by collecting additional data on web page viewing behavior, potentially using interruptive 'pop up' questions

that query the user on their processing of the materials they just encountered.

Consistent with past research, this study employed the proportional measures of emotional support exchanges as a way to rule out the potential confounding effect of writing/reading other types of supportive content in the message [13,14,19,58,59]. Nevertheless, one might wonder if the raw numbers of expression and reception are the active intervention ingredients in our study context. To test this possibility, we developed a parallel model by using the raw count measures of expression and reception as independent variables and the total posting and reading as control variables (results not shown). However, this analysis detected the multicollinearity problem caused by overly high correlations among these four raw count variables ($0.61 < r < 0.80$). Diagnostic statistics also confirmed very low values of tolerance statistics, all close to 0.20 [68]. This result suggests that our proportional measures have both conceptual and practical advantages in terms of reducing the confounding effect and avoiding a multicollinearity problem.

Of course, the present study has several limitations and thus we make suggestions that need to be taken into account in future studies. Reciprocity may be a more complex process than we explored in this study. In particular, the time sequence between emotional support received and given in each interaction is not clearly specified in our study, which suggests that one should not interpret our results as ascertaining the causation sequence that social support receiving is a prerequisite for inducing social support giving. Thus, it would be useful to extend the current inquiry into a longitudinal study, which may provide further insights concerning the mechanism underlying the reciprocal process of social support.

Second, while this study contributes to understanding the process and effect of supportive exchanges in online breast cancer support groups, we only assessed cancer patients' supportive behaviors over the entire 4-month period. However, given that needs likely continue to change through diagnosis, treatment, survivorship, and recurrence [69], longitudinal assessment is needed to examine how patterns of supportive expression and reception could vary over the course of the disease trajectory [70].

Furthermore, it is conceivable that the reciprocity may have positive effects on patient's psychosocial outcomes. To test this possibility, we created the interaction term of support giving and receiving and ran a *post-hoc* analysis (results not shown). But none of the interaction terms were found to be significant. One possible explanation for this would be that our measures of emotional support expression and reception are assessed by behavioral observation rather than recipients' self-reports of perceived emotional support, which have been found to be a stronger predictor than the actual

behavior exchanged [71]. Although our behavioral measures capture each patient's exposure to these sorts of thought and feelings in the messages she encountered, it seems likely that the perception of balance in support expression and reception is more relevant than an actual behavioral match.

This study has some practical implications for health campaign interventions. Future interventions should be systematically designed to promote and maintain the supportive exchanges by matching those who can provide emotional support with those who are in need or seek it. In other words, it is critical to attract patients who initiate and engage in supportive communication intervention in order to obtain the reciprocal benefits. In doing so, it would be useful to educate the patients about what to do when providing emotional support for sustaining active supportive exchanges among patients. For example, certain types of comforting messages or statements can be effective if they are relevant to the stressor or if they reflect person-centered concerns to the target in need, and so on [72]. If patients receive those effective supportive messages from other patients, they can experience reduced concerns related to breast cancer and ultimately will be able to provide supportive messages to help other patients in need.

In conclusion, our study illustrates the roles two key communication behaviors of production and reception of social support can play in positive psychosocial health outcomes during natural discussion within online cancer support groups. Future research must continue these sorts of investigations, merging survey data collected around a health intervention with action log data on user's online behaviors, including their reading and writing of particular messages. When computer-aided content analysis is used to code the volume of discussion posts that get produced within CMSS groups, the possibilities of this sort of analysis expand and allow novel questions to be answered.

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