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Offline Social Relationships and Online Cancer Communication: Effects of Social and Family Support on Online Social Network Building

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ABSTRACT

This study investigates how social support and family relationship perceptions influence breast cancer patients' online communication networks in a computer-mediated social support (CMSS) group. To examine social interactions in the CMSS group, we identified two types of online social networks: open and targeted communication networks. The open communication network reflects group communication behaviors (i.e., one-to-many or "broadcast" communication) in which the intended audience is not specified; in contrast, the targeted communication network reflects interpersonal discourses (i.e., one-to-one or directed communication) in which the audience for the message is specified. The communication networks were constructed by tracking CMSS group usage data of 237 breast cancer patients who participated in one of two National Cancer Institute-funded randomized clinical trials. Eligible subjects were within 2 months of a diagnosis of primary breast cancer or recurrence at the time of recruitment. Findings reveal that breast cancer patients who perceived less availability of offline social support had a larger social network size in the open communication network. In contrast, those who perceived less family cohesion had a larger targeted communication network in the CMSS group, meaning they were inclined to use the CMSS group for developing interpersonal relationships.

People suffering from a life-threatening disease, such as cancer, are likely to need social support. Family is a fundamental source of social support and the roles of family members are more pronounced in providing essential and indispensable social support in a health crisis (Harris et al., 2009). Literature has demonstrated that good family relationships and social functioning are positively associated with psychological benefits for cancer patients, such as lower levels of distress, depression, and anxiety (Baider, Rizel, & De-Nour, 1986; Baider, Koch, Esacson, & De-Nour, 1998; Edwards & Clarke, 2004). However, family support is not always effective at providing appropriate support for cancer patients, because family members do not fully understand the stresses involved in living with cancer (Shaw, McTavish, Hawkins, Gustafson, & Pingree, 2000). For example, it is possible that family members may discourage the patient from expressing distress because caregivers believe such expressions are unhealthy or because they do not feel comfortable discussing distress (Helgeson & Cohen, 1996). Attempting to force a patient with cancer to be cheerful does not always create positive results, as patients need an avenue to work through stressful thoughts and emotions.

The need for social support that is not available from immediate social networks may lead patients to seek external sources of social support. In particular, patients are likely to look for social support groups composed of people who experience similar health crises because such groups permit interactions with those who better understand their suffering. Previous research has found that cancer patients tend to participate in face-to-face or online support groups when they feel their family members fail to understand the nature of the cancer experience (Falke & Taylor, 1983; Shaw et al., 2000).

There have been efforts to examine what social support factors, such as perceived social and family support, influence cancer patients' use of computer-mediated social support (CMSS) groups, especially the length and frequency of CMSS group use (Shaw et al., 2006) and the amount of emotional support expressed (Yoo et al., 2014). However, there are few studies examining how perceived social support from immediate social networks influences the size and scope of cancer patients' communication networks in CMSS groups. Therefore, this study examines the effects of social support and family relationship perceptions on the size of cancer patients' open (i.e., one-to-many or "broadcast" posting) and targeted (i.e., one-to-one or directed posting) communication networks in CMSS groups.

Literature Review

Computer-Mediated Social Support Groups

In the field of health communication, research has established that CMSS groups are beneficial for people with health

problems (e.g., Gustafson et al., 2008; Shaw et al., 2000). CMSS groups are rooted in the same principles as those of traditional support groups (Rains & Young, 2009). Similar to face-to-face social support groups, social relationships developed through computer-mediated communication (CMC) can contribute to physical and mental health by increasing perception of universality (the realization that others have similar problems), reducing illness stigma, imparting information, and exchanging social support (Namkoong et al., 2012; Shaw et al., 2000).

CMSS groups have advantages for people with health problems in building social relationships, thereby overcoming certain limitations common among traditional social support groups (Rains & Young, 2009; Robinson & Turner, 2003). CMSS groups are not limited by time or geography, allowing group members to access more social support from others experiencing similar health crises, manage interactions more easily, and interact with others in a more controlled manner (Rains & Young, 2009; Shaw et al., 2000). These unique characteristics of CMSS groups make members more actively engaged in support group activities and build social networks with those who suffer similar health problems.

Predictors of Online Social Network Formation

The predictors of social network formation have been one of the long-standing questions in social network research. Studies on social tie formation have concerned the predictors of network phenomena, often using network properties as the outcome variables (Borgatti & Lopez-Kidwell, 2011). However, theories of social network formation and related empirical findings do not always provide clear explanations for the social ties formed within CMSS groups, owing to the unique characteristics of CMC, such as anonymity and the absence of physical presence. In the case of CMSS groups for people with a life-threatening disease, for example, the online relationship is usually built without knowing others' sociodemographic status, physical appearance, or real names. Therefore, previous explanations for social tie formation, which focus on the social relationships that develop in face-to-face communication, are not always applicable to social network ties among the CMSS group members.

Rather than relying on previous theories of network formation, we explored the potential antecedents of online communication networks in CMSS groups by drawing upon previous research examining the predictors of communication behaviors in online health communities. Shaw et al. (2006) explored demographic variables (e.g., age, education, household income, and race), clinical status (e.g., stage of cancer), self-reported physical and mental health indicators (e.g., physical well-being, emotional well-being, negative mood, and cognitive functioning), health care-related variables (e.g., perceived health competence, breast cancer-related concerns, desire for health information, and relationship with doctor), and social support factors (e.g., perceived social support and social/family well-being). They found that race, energy level, relationship with doctor, breast cancer concerns, health competence, and social/family well-being are related to writing behaviors in CMSS groups. Similarly, Han et al. (2012)

examined how demographic, disease-related, and psychological factors (e.g., information competence, need for information, perceived availability of social support) predict different levels of engagement with a CMSS group (e.g., nonusers, lurkers, and posters) and found that the lack of social and psychological resources might work as motivators to interact with other cancer patients in the CMSS group.

The literature concerning predictors of CMSS group participation provides a strong foundation for investigating the antecedents of online cancer communication networks. This is matched by analytic approaches that allow us to examine the building of communication networks in CMSS groups as they develop directly from the posting, reading, and replying behaviors of group members. Based on the literature, we examined the influence of preexisting social relationships on the development of online social relationships in CMSS groups. Beyond examining CMSS group activities with the volume/level of participation measured by the number of words written to the CMSS group (Shaw et al. 2006) and the amount of emotional support expressions (Yoo et al., 2014), we investigated the roles of perceived availability of social support and family relationship as predictors of the structure and form of communication networks in CMSS groups, for both the open network and the targeted network.

Social Relationship Factors: Perceived Social Support and Family Relationship

Individuals needing assistance are more willing to seek or receive help if their available resources are inadequate (Barbee & Cunningham, 1995; Helgeson, Cohen, Schulz, & Yasko, 2000; Plass & Koch, 2001). Past research has shown perceived social support from existing social networks plays a crucial role in cancer patients' CMSS group participation. Those lacking sufficient social support may opt to participate in CMSS groups and develop social relationships with those who suffer from a similar health crisis. Therefore, cancer patients' perception of social support availability can influence their social interactions within the CMSS group. For example, Kim et al. (2011) investigated what made breast cancer patients provide or receive emotional support in a CMSS groups. They found that perceived availability of social support was negatively related to reading and writing behaviors in an online social support group. Specifically, those who perceived themselves as having little available social support from existing social networks tended to be more actively engaged in supportive communication behaviors, seeking help from those who had experience with the same illness. In contrast, cancer patients are less likely to participate in social psychological support groups when they feel well supported in their existing social network (Helgeson et al., 2000; Plass & Koch, 2001). Accordingly, we predicted that perceived availability of social support would reduce the likelihood of building social relationships in a CMSS group:

H1. The perceived availability of social support from existing social networks will be negatively associated with the size of a cancer patient's online communication network.

Family is the most basic and principal social system in most societies. Not surprisingly, cancer patients often indicate that family is the most frequent and primary source of support (Harris et al., 2009), and therefore the socioenvironmental characteristics of family have been widely examined in the context of cancer treatment and cancer communications (e.g., Biesecker et al., 2000; Fobair et al., 2001; Kim et al., 2011). Moos and Moos (1986) assessed family environment with three dimensions: family relationship, personal growth, and system maintenance. Among these, the family relationship was found to play an important role in the way cancer patients cope with their psychological health problems (e.g., Siminoff, Wilson-Genderson, & Baker, 2010; Yoo et al., 2014).

In this work, family relationship was assessed with three domains: cohesion, expressiveness, and conflict (Moos & Moos, 1986). Family cohesion refers to shared affection, commitment, helpfulness, emotional bonding, and caring among family members (Moos & Moos, 1986; Siminoff et al., 2010). Family expressiveness is defined as an open and direct style of verbal and nonverbal expression in family communications (Yoo et al., 2014). In other words, it refers to the "extent to which family members are encouraged to express their feelings directly" (Siminoff et al., 2010, p. 1287). Family conflict concerns the open expression of anger, aggression, and interactions resulting from incompatible goals or violations of relationship expectations among family members (Comstock & Strzyzewski, 1990; Moos & Moos, 1986; Yoo et al., 2014). Siminoff and her colleagues (2010) found that family cohesion is negatively associated with the levels of depressive symptoms, meaning cancer patients who live in a cohesive family relationship suffers lower levels of depression. Along these same lines, Bauman, Gervey, and Siegel (1993) found that family expressiveness was an important motivational factor encouraging cancer patients to participate in social support groups.

These aspects of family relationships are strong predictors of the quantity and quality of the social support cancer patients receive. For example, women with breast cancer can seek and receive needed support from family members when they perceive the family relationship as cohesive, expressive, and lacking conflict (Holahan & Moos, 1981). Conversely, patients who live in less cohesive and less communicative family environments often fail to receive suitable support from their family and, as a result, have to rely on external support sources (Becvar & Becvar, 1999). Thus, cancer patients who do not receive sufficient family support, which results from poor family relationships, are more likely to participate in social support groups (Lieberman & Borman, 1979; Taylor, Falke, Shoptaw, & Lichtman, 1986). Cancer patients tend to participate in social support groups when their family relationships cause them stress and when family members do not understand the hardship of the cancer experience (Falke & Taylor, 1983). Abe-Kim, Takeuchi, and Hwang (2002) also found that individuals with high levels of family conflict are more likely to seek help from social support groups. In contrast, cancer patients do not actively participate in social support groups if they receive sufficient family support (Falke & Taylor, 1983; Plass & Koch, 2001).

Accordingly, we hypothesized that these aspects of the patient's family relationship will serve as predictors of social relationship building in the CMSS groups:

H2a.   Family cohesion will be negatively associated with a cancer patient's online social relationship building.

H2b.   Family expressiveness will be negatively associated with a cancer patient's online social relationship building.

H2c.   Family conflict will be positively associated with a cancer patient's online social relationship building.

Methods

Building Open and Targeted Communication Networks

To examine how cancer patients develop social relationships in CMSS groups, we measured the participants' online social network size, using degree centrality. Degree centrality refers to the number of social ties linked to a person. It allows us to know how directly connected a person is to others in a network. There are two kinds of degree centrality: in- and out-degree. In-degree is the number of ties directed to a person and out-degree is the number of directional ties emanating from the focal person (Wasserman & Faust, 1994). Different from other sociometric measures, the degree centrality was not influenced by the relationships outside of a focal individual. In this respect, degree centrality was often regarded as an egocentric measure of network size (Borgatti, Jones, & Everett, 1998), given that it could be measured without data metrics about all network members' relationships.

Before measuring a person's network size via degree centrality, we identified two distinct communication networks based on the CMSS group participants' communication behaviors. In a CMSS group, a person can write a message to all group members. Even when a participant writes a message to specific targets, he or she is aware other group members may read the message. Therefore, we were able to visualize two types of social network by identifying message reception behaviors. The first social network is referred to as an open communication network, in which an individual's in-degree indicates the number of people whose messages that person read, whereas out-degree indicated the number of people who read messages the person wrote. On the other hand, there are messages that explicitly referred to specific individuals as the targets of the messages. That is, people can use the CMSS group as an interpersonal communication channel, identifying the target of messages in their post. The second social network is referred to as a targeted communication network, which could be established by identifying the referred persons or targets in a message. The social network was thus constructed by identifying that a person specified a target in his or her messages (out-degree) and that a person was referred to as a target of other's messages (in-degree). In sum, the open communication network represents one-to-many or group communication and the targeted communication network

reflects one-to-one or interpersonal communication occurring in the CMSS group.

To examine the predictors of online social relationships, we used the in-degree measure for the open communication network (i.e., how many people's messages a participant read) and the out-degree measure for the targeted communication network (i.e., how many people the participant directed messages). We tested the hypotheses for the open and targeted communication network separately.

Study Procedures

The data we analyzed were collected from two large randomized controlled trials funded by the National Cancer Institute (NCI). The two studies examined how the Comprehensive Health Enhancement Support System (CHESS) can be most beneficial to cancer patients (Baker et al., 2011). CHESS is an Internet-based and multicomponent intervention providing patients with crucial cancer information, interactive coaching, and communication services (Gustafson et al., 2008). The two clinical trials adopted a cross design examining whether CHESS yields greater benefits when it is integrated with a cancer information specialist (Baker et al., 2011).

Recruitment was conducted from April 1, 2005, through May 31, 2007, from three cancer care facilities. Eligible subjects were within 2 months of a diagnosis of primary breast cancer or recurrence at the time of recruitment. From the three study sites, 1,034 women were approached for study participation and 661 agreed to join the studies. After the subjects answered the baseline questionnaires, they were randomly assigned via a computer-generated list to one of six conditions: (1) Internet only (n = 112), (2) CHESS information service only (n = 118), (3) CHESS 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). After randomization, any patient who did not have access to a computer with Internet was provided a computer and free Internet access for the 6 months of the study. All computers were equipped with a CHESS browser that automatically collected user data. Every study participant took a training session (Baker et al., 2011). Among the six conditions, three conditions (CHESS information and communication services only, full CHESS, and mentor and full CHESS) had the online discussion group service in CHESS. Of the 325 participants assigned to the three groups, 243 women either wrote or read messages during the 6-month study period. The analysis in this study was limited to these women who connected with other CMSS group members via the online discussion group features.

Discussion Group Data Management

The action logs gathered by the CHESS database management system consisted of information on all system users' online activity. The action log file captured the clicks on hyperlinks to posts and every keystroke of message production, enabling extremely fine-grained analysis of the CMSS group participants' communication with one another. With the action log data, we identified (a) who posted a message, (b) when the message was posted, and (c) who read the message. Analyzing the log files, we processed the data for social network analysis (i.e., degree centrality) and further merged with survey data for various statistical analyses.

Based on the result of log data analysis, we created an edge list including the message sender (writer) in the first column and the message recipient (reader) in the second. With the edge list, we constructed social networks because the data included relevant information on the communication flows between message senders and recipients. We created the edge lists for the two approaches separately to construct two distinct communication networks. In the open communication network, we focused on whose messages a patient had read. In the targeted communication network, we identified and matched the target(s) of the messages with the message sender. The resulting networks are presented in Figure 1.

Analytic Approach

We performed ordinary least square (OLS) hierarchical regression analysis to examine the predictors of cancer patients' online social relationships. We also conducted post hoc power analyses to assess the degree of reliability of our findings. We employed Gpower3.1 software to calculate power in multiple regression analyses with alpha level (.05), sample size (H1 = 220; H2 = 108), and the number of predictors (10). Following Cohen's (1988) criteria, we predetermined the weak (f^2 = .02), medium (f^2 = .15), and large effect size (f^2 = .35) (Faul, Erdfelder, Lang, & Buchner, 2007). The results indicate our study had acceptable power to detect moderate to large effects (H1: f^2 = .02, power = .23; f^2 = .15, power = .99; f^2 = .35, power = 1.00; and H2: f^2 = .02, power = .12; f^2 = .15, power = .75; f^2 = .35, power = .99).

Measures

Network Size: Degree

As already noted, degree was measured by the number of social ties directly connecting a participant to others (*alters*) in a network. Two measures of degree, in-degree and out-degree, were based on the directionality of the connections. In-degree was the number of ties directed to an actor (i.e., the number of alters who connected to an ego). Out-degree referred to the number of directional ties emanating from an actor (Wasserman & Fuast, 1994). Given our research questions, predictors of online social relationship building, we assessed in-degree for the open network (M = 29.29, SD = 30.75) and out-degree for the targeted network (M = 9.42, SD = 11.56).

Perceived Availability of Social Support

The Wisconsin Social Support Scale was used to measure an individual's perceived and expected availability of social support. This six-item scale has been consistently used in previous CHESS research (Gustafson et al., 2005; Kim et al., 2011; Shaw et al., 2006), with access to CHESS typically associated with greater perceived support. Participants are asked to indicate on a 5-point scale (0 = *not at all*, 4 = *very much*) how true each statement is: (a) "There are people I could count on for emotional support," (b) "There are people who will help me
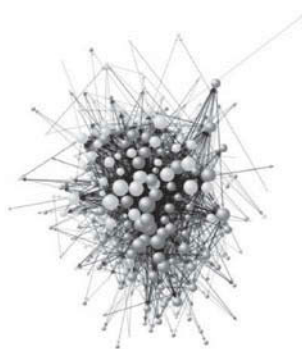
(a)

Open communication network

(b)

Targeted communication network
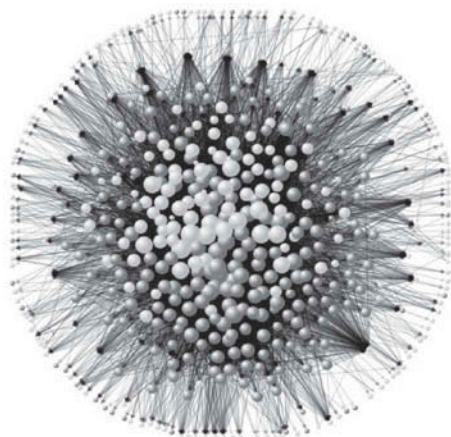
Note: Social network is defined by message

reception.

- Participants (vertices = 504)

- Communication ties (edges = 14,358)

- Vertices color:

  Dark sphere = included in the H test

  Bright sphere = not included in the H test

  Size: popularity (out-degree)

- Edges opacity = number of messages

Note: Social network is defined by message

expression and reception.

- Participants (vertices = 198)

- Communication ties (edges = 2,253)

- Vertices color:

  Dark sphere = included in the H test

  Bright sphere = not included in the H test

  Size: expansiveness (out-degree)

- Edges opacity = number of messages

Figure 1. Online social networks: Open and targeted communication networks.

understand things I'm finding out about my illness," (c) "I am pretty much all alone," (d) "There are people I could rely on when I need help doing something," (e) "There are people who can help me find out the answers to my questions," and (f) "There are people who will fill in for me if I am unable to do something" ($M = 3.43$, $SD = .66$, α = .89).

Family Relations Index (FRI)

We used the Family Relations Index (FRI) to assess the participants' perception of family relationships and levels of supportiveness from family members. The FRI is a subscale of the Family Environment Scale (FES), which was developed and used to assess a family's social climate (Fobair et al., 2001; Moos & Moos, 1986). FES has demonstrated test–retest reliability, stability, and predictive validity in previous research on families with members affected with cancer (Biesecker et al., 2000; Fife, Norton, & Groom, 1987; Noll, Gartstein, Hawkins, & Vannatta, 1995). Provided with 27 statements, respondents were asked to decide which of the statements were true or false regarding their immediate family. FRI consists of three dimensions of family

relationships: cohesion, expressiveness, and conflict. Cohesion is the degree of commitment, help, and support family members provide for one another (pretest: $M = 0.92$, $SD = .20$, $KR20 = .75$). Expressiveness is the extent to which family members are encouraged to act openly and to express their feelings directly (pretest: $M = .70$, $SD = .28$, $KR20 = .64$). Conflict is the amount of expressed anger, aggression, and disagreement among family members (pretest: $M = .25$, $SD = .30$, $KR20 = .71$).

Results

Patient Characteristics

The open communication network was constructed with 243 participants who engaged in the CHESS discussion groups. The targeted communication network included 117 of these 243, focusing on those who used the CMSS group for interpersonal communication by directing messages at particular users. Approximately one-half of the CMSS group users (48.1%) developed interpersonal relationships, sending and

Table 1. Demographic and clinical characteristics of open and targeted communication networks.

Characteristics	Open (n = 243)	Targeted (n = 117)
Age (years)		
Mean (SD)	51.05 (9.19)	50.52 (8.74)
Education		
Did not complete junior high/middle school	2 (0.8%)	1 (0.9%)
Did not complete high school	4 (1.7%)	1 (0.9%)
High school degree	37 (15.3%)	15 (12.8%)
Some college courses	64 (26.4%)	35 (29.9%)
Bachelor's degree	63 (26.0%)	30 (25.6%)
Some graduate courses	18 (7.4%)	12 (10.3%)
Graduate degree	54 (22.3%)	23 (19.7%)
Clinical characteristics		
Surgery before intervention (within 1 month)		
Yes	128 (54.7%)	58 (51.8%)
No	106 (45.3%)	54 (48.2%)
Time: diagnosis to intervention (days)		
Mean (SD)	69.35 (28.72)	62.20 (28.54)
Experimental condition		
CHESS: information + support	80 (32.9%)	36 (30.8%)
FULL CHESS: information + support + coaching	83 (34.2%)	42 (35.9%)
FULL CHESS + mentor	80 (32.9%)	39 (33.3%)

Table 2. Hierarchical regression analyses predicting online social relationships in open and targeted communication networks

	Open		Targeted	
Criterion variable	In-degree	p	Out-degree	p
Block 1. Experimental factors				
Full CHESS	.053	.507	.129	.260
Full CHESS + mentor	.032	.683	.030	.781
ΔR^2 (%)	0.2	.779	1.1	.596
Block 2. Demographic factors				
Age	−.124†	.066	−.019	.840
Education	−.076	.260	−.165†	.086
ΔR^2 (%)	2.1	.101	2.9	.212
Block 3. Disease-related factors				
Time: diagnosis to intervention	−.172*	.016	.169	.102
Surgery within 1 month prior to pretest (yes = 1)	−.043	.537	−.154	.129
ΔR^2 (%)	2.9*	.038	5.0†	.065
Block 3. Social relationship				
Perceived social support	−.207**	.009	−.012	.921
Family environment				
Family coherence	.085	.289	−.325**	.005
Family expressiveness	.018	.821	.083	.477
Family conflict	.021	.778	−.057	.560
ΔR^2 (%)	3.4	.101	8.1†	.059
Total R^2 (%)	8.7*	.035	17.2*	.040

Note. Cell entries are final standardized beta (β). Open communication network (n = 220); Targeted communication network (n = 108).
†$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$.

receiving targeted messages. Table 1 summarizes the CMSS group users' demographic and clinical characteristics.

We examined the predictors of online social network interactions in CHESS. Specifically, we investigated the influence of preexisting social relationships on a cancer patient's network size in the CMSS group. To more accurately isolate the predicting factors of online social relationships, we included demographic and disease-related variables as covariates, because these two factors have been found to be significant predictors of CMSS group participation among cancer patients (Kim et al., 2011; Shaw et al., 2006).

Perceived social support and family environment were hypothesized predictors in this study. As shown in Table 2, in

the open communication network, perceived availability of social support was negatively associated with network size (β = −.21, $p < .01$). That is, when participants perceived they had less social support available to them, they have a larger online social network of users whose posts they consume. However, none of the family environmental factors (i.e., cohesion, expressiveness, or conflict) was related to the network size. Thus, H1 was supported for the open communication network, but not H2. Among the control variables, the period between diagnosis and the intervention was negatively associated with the network size (β = −.17, $p < .05$). That is, more recently diagnosed cancer patients consumed messages from a larger network of users.

In contrast to the findings for predictors of network size in the open communication network, no significant relationship existed between perceived social support and network size in the targeted communication network, providing no support for H1. In other words, the lack of perceived social support was not related to developing personal relationship in the CMSS group. Among family environment factors, only family cohesion was significantly related to out-degree in the targeted communication network. As we predicted, family cohesion was negatively associated with building a targeted communication network (β = −.33, $p < .01$). These results reveal that people in less cohesive families are more inclined to send personalized messages in the CMSS group, indicating interpersonal relationships with other members in CMSS groups.

Discussion

To provide more comprehensive understanding of social network formation in a CMSS group, we investigated the predictors of communication network size in the CHESS discussion group. We constructed open and targeted communication networks to reflect different types of social relationships that could develop in the CMSS group. The open communication network considers group communication behaviors, in which messages do not have a specific target, whereas the target communication network reflects interpersonal communication behaviors, in which patients exchange specified social support. Notably, we found the two communication networks have different predicting factors. Perceived availability of offline social support is negatively related to the individuals' network size in the open communication network, but it does not significantly affect the network size in the targeted communication network. In contrast, family cohesion is negatively associated with the patients' network size in the targeted communication network but not in the open communication network.

These results support the claim that a social support group may be of particular importance for those who perceived a deficiency in proper social support from their immediate social network (Helgeson & Cohen, 1996). This study shows that breast cancer patients' participation in a CMSS group is associated with a perceived deficit in available social support. That is, women with breast cancer tend to have greater network size in the open communication network (reading more people's messages in the CMSS group) when they perceive

that they do not have enough social support from their offline social network.

However, the lack of social support did not appear to influence the degree to which participants built interpersonal relationships in the CMSS group. Rather, a lack of family cohesion increases the likelihood of building interpersonal relationships (targeted posts directed at specific users) in the CMSS group. Although family expressiveness and conflict did not influence the patients' online social interactions, family cohesion did. In other words, cancer patients appear to have a greater need to build relationships online when their family members are less helpful and have less shared affection and emotional bonding.

CMSS groups, therefore, provide an important venue for cancer patients who do not receive adequate social support from family members. Interpersonal relationships developed in CMSS groups appear to compensate for a deficiency in family support and provide an important alternative family in a health crisis. These findings are particularly important given that qualities of the family relationship (Weihs & Reiss, 2000), particularly family cohesion (Yoo et al., 2014), are among the most important factors affecting a cancer patient's coping attitudes and behaviors. It is noteworthy that Yoo et al. (2014) found women who lived in the families with higher level of cohesion were likely to spend more time in the CMSS group. Our finding shows the increased time spent in the CMSS group does not mean the increase interpersonal communications with the CMSS group participants. Rather, cancer patients whose family is not cohesive seek more interpersonal interaction, even though they might spend less time in the CMSS group.

Contrary to our hypotheses, family expressiveness and conflict were unrelated to how cancer patients build communication networks in a CMSS group. This is somewhat surprising, as family expressiveness (Ballard-Reisch & Letner, 2003; Given, Given, & Kozachik, 2001) and conflict (Reinhard, Given, Petlick, & Bemis, 2008) have been regarded as beneficial and detrimental factors, respectively, for patients fighting cancer. Nonetheless, our finding is similar to those of Yoo and his colleagues (2014), who found that family expressiveness and conflict were not associated with the time spent in CMSS groups. These findings need additional studies that examine why the three family relationship components play different roles in building communication networks, along with their connection to other usage features of CMSS groups.

Our research has three limitations that future researchers should consider. First, we constructed the open and targeted communication networks by considering the available features of group and interpersonal communications that occurred in the bulletin board-style discussion group in CHESS. However, our operationalization of targeted communication did not completely reflect how one-to-one communication occurs through other mediums, such as mobile devices. Although people can communicate with targets by specifying them by name in messages, they cannot avoid having the messages exposed to the group at large. Therefore, the distinction between the open and the targeted communication network may not be as sharp in this CMSS group as it is in other contexts. Second, this study focused only on a specific disease context because the CHESS module used in the current research was designed with a particular focus on breast cancer patients' outcomes. In future studies, therefore, it would be

worthwhile to test the findings of this study in other social and clinical contexts. Finally, although the items used to measure perceived social support have been interpreted as reflective of offline social relationship (e.g., Kim et al., 2011; Shaw et al., 2006), the measures themselves do not exclude social support received from other online social interactions. Thus, it is possible that participants took their previous online connections into account when assessing perceived availability of social support.

The evolution of information and communication technologies has significantly expanded individuals' scope of social interactions, allowing them to engage in virtual community activities. CMSS groups have been of particular interest in the field of health communication because they provide an alternative to traditional social support groups that have been shown to have substantial benefits but also significant limitations (e.g., time and geographic) in helping people with serious diseases. Our research shows the CMSS group's potential to be an alternative resource for those who lack social support from their families and close friends. The theoretical and practical implications of this sort of compensatory behavior are considerable. First, this suggests that online interactions may provide similar psychological benefits as interpersonal, even familial, relationships. If the social support available online can stand in for the absence of offline social relationships, research should begin to examine the psychological benefits of these interactions. Second, the potential to provide these benefits to those who otherwise would be unable to receive them through laptop computers and mobile phones may provide a cost-effective means of addressing psychosocial health issues that otherwise need to be addressed in counseling. For women with breast cancer, who often have compromised immune systems due to the side effects of chemotherapy, online communities and groups may be the only source of social support. Future CMSS group research, therefore, should address these issues and explore prominent predictors of online social relationship building when examining the health outcomes, especially among cancer patients.

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