DIVERSITY OF ONLINE SUPPORT NETWORK AND RECEIVED SOCIAL SUPPORT
FROM SOCIAL COMPENSATION AND SOCIAL ENHANCEMENT PERSPECTIVES

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ABSTRACT

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Diversity of support network refers to the variety of relational ties people have in their social support networks. Network diversity has been shown to positively associate with one's received social support. Online support groups are important sources that cancer patients seek support from. Relatively less attention has been paid to examining the composition and diversity of online support networks. This study aims to: (1) understand the composition of online support networks in terms of major types of relational ties people seek support from, (2) examine the relationship between diversity of online support network and received social support from such network, and (3) investigate how offline network resources may moderate the relationship between participation in online support groups and received social support from online networks. We recruited participants from two large online cancer support communities to complete an online survey. A total of 386 participants were included in the study. The results show that people's online support relational ties contain several dimensions. Online diversity and online received social support are positively related. A moderating effect was found of offline diversity on the relationship of online media use and the received online social support. The result of the hierarchical regression is aligned with the social compensation theory. Online diversity of support network is an important concept that deserves more attention. It not only indicates the potential social support resources in the online network but also highly relates to one's offline network and the overall social support.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The diversity of social network is an important network feature that describes the extent to which one's social network contains different types of social relationships (Cohen, 1997). A person's support network consists of social contacts who the focal person may seek support from when coping with stressful life events such as diseases. The diversity of one's support network indicates the potential resources accumulated through the relationships among people in that network (Lin, Cook, & Burt, 2001). Different relational ties provide specialized social support. Network diversity is shown to be positively related to one's received social support (Agneessens, Waege, & Lievens, 2006). With the general access to the Internet, online support groups have been an important source for people to seek support from, while little attention has been paid to the composition of one's online support network.

Online health support groups are becoming more important sources for patients to seek support (Haberstroh & Moyer, 2012). Most online ties are weak ties, which offers the opportunities to contact people with similar health conditions and concerns (Rains & Keating, 2011). Participating in an online support group is expected to be an approach for people who are disadvantaged in offline social recourses to overcome inequality and gain more diverse and optimal social support (Rains & Tsetsi, 2016).

While under the general concept of online weak ties, the relationships of online contacts are not homogenous. Various relationship types like peers, online friends, strangers, and helping professionals exist in one's online support groups (Naslund et al., 2016; Mesch & Talmud, 2006; Rains & Wright, 2016; High & Steuber, 2014). One of the aims of this study is to understand the composition of online support networks in terms of major types of relational ties that people seek

support from. Then, we examined the relationship between the diversity of online support network and received social support from such network.

Online network and offline network are not independent of each other. The results of the research about the relationship between people's offline support resources and their use of the internet are mixed (Kraut et al., 2002). So, we also investigated how offline support resources may moderate the relationship between participation in online support groups and received social support from online networks. We hypothesize that diversity of online support network positively predicts received support from that online network. In addition, we tested the competing hypotheses derived from social enhancement and social compensation perspectives, with respect to the role of offline support resource in moderating the relationship between media use and received support.

LITERATURE REVIEW

Network Diversity

A personal network is composed of all others (alters) with whom a person (ego) has a

certain relationship (Agneessens, Waege, & Lievens, 2006). The alters in one's personal network

provide different kinds of supportive recourses. The role relation that the alter has with respect to

ego is an important characteristic (Wellman & Wortley, 1990). Some role relation may

potentially provide sources of support, including immediate kin, romantic partner, other

relatives, etc. When looking for different kinds of social support, people refer to role relation as a

reference for explaining why some types of support are given by some types of the alters

(Freeman & Ruan, 1997). The way one behaves toward others is to some degree constant and

guided by rules and norms (Freeman & Ruan, 1997). One can assume what kinds of social

support that s/he can expect from a specific alter based on the role relations (Wellman &

Wortley, 1990). The types of support for a specific role relation can describe the diversity of the

support network (Agneessens, Waege, & Lievens, 2006).

Network diversity captures the extent to which one's social network contains different

types of social relationships (Cohen, 1997). High diversity of a person's network indicates

various kinds of resources that are available in the network (Lin, Cook & Burt, 2001). Social

network diversity has considerable influence on people's received social support (Agneessens,

Waege, & Lievens, 2006). Social network diversity also relates to social capital. Social capital is

defined as the aggregate of the actual and potential resources available from the relationships in

one's personal network (Bourdieu, 1985). The potential of social capital is maximized in

people's social network when the diversity is high (Hampton et al., 2011b). Not only the amount

of social support but the variety of the support is also important (Agneessens, Waege, & Lievens, 2006).

Figure 1
An Example of the Diversity of a Person's Network
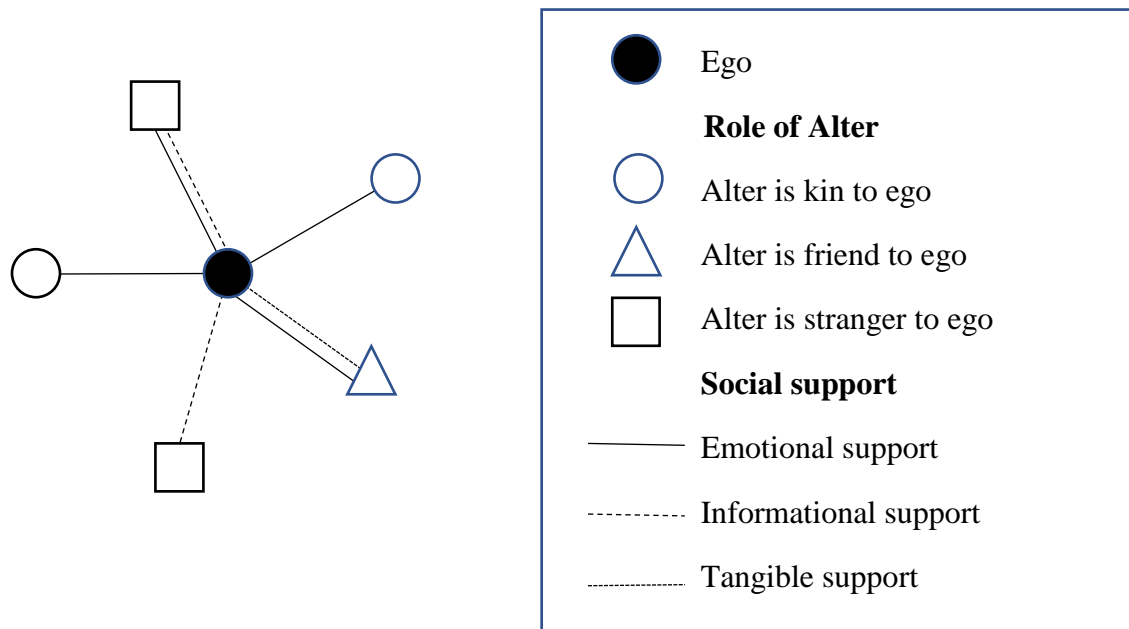
The composition of one's network affects the provision of support. Different types of relationships provide different kinds of social support (Agneessens, Waege, & Lievens, 2006). Agneessens, Waege, and Lievens's (2006) study about the typology of support network found that people can expect different types of support depending on their alters' specified roles. The results show that partners are the most important ties for all types of support except financial support. Immediate kin are the main source of financial support and emotional support. Friends are important for emotional support but not for instrumental support. Acquaintances and mates provide emotional support and companion. Colleagues and doctors are only for having conversations (Agneessens, Waege, & Lievens, 2006). Wellman & Wortley's (1990) study about

specialized support provided by different relational ties suggests that physically accessible ties provide services; women provide emotional support; friends, neighbors, and siblings make up half of all the supportive ties (Wellman & Wortley, 1990). The diversity of supportive resources in one's social network assures the stable and accessible support. People decide to approach the potential support providers based on their perceptions of the possibility to receive the support that they need, as well as depend on the relationships they have with the providers (Cutrona & Russell, 1990).

Cancer Patients and Online Health Communities

In recent years, the popularity of media use has stimulated many applications, including online health communities and health information seeking. In 2010, 18% of the adult internet users reported that they had used the internet to find others with similar health concerns (Fox, 2011). The National Cancer Institute's survey shows that an estimated 7.5 million adult Americans had visited a health-related support group in 2012 (Rains & Wright, 2016). It is argued that the internet created a context where people can receive support that uniquely meets their needs and situations (Rains & Wright, 2016). The Pew Internet and American Life Project survey finds that people who use the internet receive significantly greater support than the non-users (Hampton et al., 2011a).

People seek support online because it offers several advantages. First, to contact people with similar experience is a key motivation for people to use the online support groups, especially in online health support groups (Haberstroh & Moyer, 2012). Weak ties that people form through the internet have unique values because they offer the access to novel information and can be more optimal to people's circumstances (Wright & Miller, 2010). Similarity plays an important role in online social support (Wright & Bell, 2003). The perceived similarity of the

users positively relates to the amount of perceived support available in the communities (Campbell & Wright, 2002). Having similar experience is even more important than the similarity of age, gender, and marital status in providing and receiving emotional support (Suitor, Keeton, & Pillemer, 1995).

Also, seeking support online is related to overcoming the inequality of the offline network resources. Before the general use of the Internet, social support availability is related to individual's demographic features (i.e., age, education, race) and offline social network features (i.e., network size), mostly provided by strong ties, such as family and friends (Rains & Keating, 2011). Strong ties are suggested to have an important positive influence on people's social support. In this case, social support inequality is hard to overcome in offline environments (Rains & Keating, 2011). The implication of the internet use is expected to be a mean for people to gain more and diverse social support. It is especially valuable when support in the offline relationships is lacking (Rains & Wright, 2016).

For online health support groups, the stigma people receive will lead them to seek support online (Rains & Wright, 2016). Research shows that people who are afraid of others finding out their conditions or who are worrying about the stigma are more likely to use online support communities (DeAndrea, 2015). The anonymity of the internet also relates to people's participation in online support groups and their preference of receiving support from weak ties (Wright & Rains, 2013).

In addition, accessibility is a key factor that enables the internet to enhance the use of online support groups (Rains & Wright, 2016). Geographical distances are no longer a major boundary of seeking and receiving support resources.

Thus, the features of seeking support online provide many benefits. For people with health concerns, the internet provides more opportunities for them to connect with potential weak ties who have a similar experience. They can provide and receive more optimal support to meet their needs for their health issues. The accessibility and the anonymity of the internet offer people a more convenient environment to seek social support.

Online Weak Ties

Online communities allow anyone to make contributions to the communities, and the success of online communities relies on the users' contributions (Lenhart et al, 2004). It was thought that the benefits of the online communities may be single-sided with people accessing the community resources and do not posting. While actually, these users are providing values by adding importance to the community and in changing reader's beliefs (Karz, 1998). By visiting a particular online community, even users who've never made a post exhibits small-scale activities that Granovetter (1973) identified as the source of weak ties with the community. These connections are fragile and easy to break, they can be more instrumental than strong ties under some circumstances (Friedkin, 1980). Weak ties can be important for job seeking (Granovetter, 1973), for the diffusion of ideas, and for the advice network (Constant, Sproull, & Kiesler, 1996). In online communities, weak ties not only help to facilitate information distribution, but also establish commitment that encourages people to contribute (Bateman et al., 2011).

For online communities, many of them are composed of weak ties based on people's particular beliefs and interests, avoiding exposures to alternative opinions (Norris, 2002). Ideological homogeneity is expected in the online communities (Norris, 2002). Many studies about political opinions, racial group (Wojcieszak, 2010), and game-based groups (Lortie & Guitton, 2012) consider online communities as homogeneous. Studies on online communities

thought of depression communities as homogeneous groups and rarely examined the differences between the segments (Nimrod, 2013).

While in the online health community literature, there have been different focuses on different relational ties in the communities. Some of the studies focus on the online relationship types such as online peers, helping professionals, and even strangers. These different relational ties can have different impacts on people's social support, health outcomes, and well-beings (Naslund et al., 2016; Mesch & Talmud, 2006; High & Steuber, 2014). Though the main combination of people's online support network in the health communities is weak ties, weak ties are not homogeneous. We believe that online support communities are not as homogeneous as expected and the diversity of online network can be important in the communities.

Diversity of Online Support Network

Online support groups contain a mix of all types of relationships. People's satisfaction of social support depends on the stressful events they are facing and their relationships with the support providers (Cutrona & Russell, 1990). Little literature mainly focuses on the relational ties of the online support network, but different types of relationships are sometimes captured in previous online support studies (Mesch & Talmud, 2006; Naslund et al., 2016; High & Steuber, 2014).

Most online ties are considered as weak ties, and they are the major support resources in online support networks. From the overall general term of weak ties, some specific types of relational ties have been investigated, like peers, strangers, and helping professionals. Seeking peers for support is sometimes the main motivation that people use online support groups (Naslund et al., 2016). Online friends and strangers may offer different support for the users

because of their different closeness (Mesch & Talmud, 2006). The health professionals are providing various support more than only information (High & Steuber, 2014).

But it is still unknown about the composition of relational ties of people's online network. Various relational ties can be important predictors of people's received social support in their network, so investigating the composition of the relational ties in people's online support groups will help to better understand the relationship between the participation of online support networks and the received social support.

RQ1: What are the major types of relational ties in people's online support networks?

The variety of online relational ties is important to online support networks and represents its diversity. Like the overall network diversity, online network diversity captures the variety of relational ties that people have in their online social networks. It indicates the potential social support that is available from that online network. Previous literature has mentioned several different online relational ties that are influential to online received social support.

Under the general concept of weak ties, different kinds of relational ties can be identified in one's online support network. For online friends and strangers, the closeness between online ties can have a large variance. Some of them can grow into interpersonal relationships and become important friends to each other. For those online ties that developed intimacy, online ties are strong and meaningful (Mesch & Talmud, 2006). A study about online support's influence on negative emotions shows that social support provided by an online friend is more effective than the support provided by strangers in attenuating people's negative emotions (Teoh et al., 2015).

Club members and acquaintances in the online support group also provide valuable social support, though they only have low interdependence on each other and only contact in limited contexts (Rains & Keatings, 2011). Club members and acquaintance are the common ties that

one has in their online health support groups. Even if they are not familiar in person, the informational exchange and the comfort they provide can have significant meanings to the support group users. By knowing that there are people who can provide potential support to meet the need in your support network is beneficial to people's well-being (Rains & Wright, 2016).

Peers are defined as people who have similar health conditions and concerns. Peers are important support-providers in these online support groups (Rains & Keating, 2011). People believe that only those in the same situations are more understandable (Cummings, Sproull, & Kiesler, 2002). Peer-to-peer support is especially important to people with illness (Naslund et al., 2016). A research about severe mental health and peer-to-peer support shows that people report benefits from interacting with online peers. Better social connections, sense of belonging, and coping strategies are gained from online peers (Naslund et al., 2016).

Health-care specialists like nurses and doctors also act as support providers in online support networks. Their support is shown to be positively related to positive attitude, improved coping, and health outcomes (High & Steuber, 2014). Though helping professionals are traditionally viewed as information providers, they can provide various types of support to patients (High & Steuber, 2014). Health professionals are the credible sources that can provide different kinds of support, so the accessibility to health professionals is an important reason for patients to use online support groups (Wang et al.,). People's perceived credibility of the online community members is related to people's satisfaction with the online social support and the availability of emotional support from the communities (Wright, 2000).

It is reasonable to say that the relational ties in people's online networks are not homogenous. Different types of online relationships might provide various support. In the online

network, it may be also true that not only the number of ties matter but also the variety of the network ties is related to the users online received social support.

        H1: Diversity of online support network is positively related to one's online received social support.

Social Enhancement and Social Compensation of Media Use

        The internet affords access to the novel support of weak ties, which is more beneficial to those who are disadvantaged in offline social support resources (Wright & Miller, 2010). The results of the research about the relationships between people's offline support resources and their use of the internet are mixed. Conflicting hypotheses exist to explain the influence of internet use on social support. The two main hypotheses are social enhancement ("rich get richer") and social compensation ("poor get richer") (Kraut et al., 2002).

        Social enhancement perspective (Kraut et al., 2002) believes that people who have already received greater social support offline will gain more benefits from using the internet (Hampton, 2011b). People whose demographic features and offline network features that provide more support resources will maximize their available social support from the internet. The use of internet not only helps to reinforce one's existing close ties with family and friends but also provides a new access to a more diverse network of weak ties (Wright & Miller, 2010). Offline network diversity is positively related to people's crosscutting exposure in SNSs (Park & Kaye, 2017).

        Social compensation perspective (Kraut et al., 2002) believes that people who have fewer offline social support will gain more benefits from using the internet. The main reason is that internet allows people to get access to weak ties that are more optimal to meet their needs. Social compensation will occur when people who are originally disadvantaged in social support

11

resources become motivated to strengthen their offline relationships and expand new connections (Rains & Tsetsi, 2016). Much research in social support and health issues are aligned with social compensation perspective. Rains & Keating's (2011) research about health blogging and social support shows that blog readers are distinct support resources from bloggers' family and friends. When support from a strong-tie relationship is lacking, blog readers' support is negatively related to people's loneliness and positively associated with their personal growth. Chung's (2013) study shows that people's satisfaction with their offline social resources is inversely related to their preference to interact with online community members. Rains & Tsetsi's (2016) study implies that internet use will lead to expanding and mitigating people's inequality of social support because of demographic and offline network factors.

The social enhancement and compensation hypotheses indicate competing perspectives about how internet use affects people's perceived and received social support. Internet users might have different outcomes of social support depending on their demographic and offline network features. Offline diversity is a key variable indicating offline social support (Agneessens, Waege, & Lievens, 2006), which has great influence on people's use of the internet and the potential social support gain from online networks (Kraut et al., 2002).

Media use can be measured from many perspectives. Frequency is a traditional measure of the overall media use. A positive relationship was found between the overall media use (frequency) and perceived social support (Hampton et al., 2011a). While some studies used frequency as the only measure of media use and ignored other measures of media use that can also be important. Membership duration can be an important measure of media usage (Boulianne, 2015). For example, Simsek & Sali's (2014) study found that social media membership increases the users' psychological capital. Membership is used as a measure of the

social network building variable (Boulianne, 2015). With the increasing level of engagement, the users are more familiar with the unique value of the online support group and play their roles in the communities better (Tsai & Bagozzi, 2014). Membership impacts that level of comfort that the users are willing to share their personal and medical information (Rocha et al, 2017).

Based on the discussion of media use and online received social support, and the competing hypotheses of social enhancement and social compensation perspectives, we expect that people's offline network features can moderate the relationship of people's participation in online health support groups and their online received social support. This research will investigate how people's offline network diversity moderate the relationship between people's participation in online health support groups and the received social support.

RQ2: How does the offline network diversity influence people's use of online health support groups and their online received social support?

METHOD

Data

The study used a secondary dataset from a related study. The participants of the dataset were recruited from two large online cancer communities. We used Yahoo! And Google's search engines with the keywords "cancer AND 'online support' AND group OR community" and reviewed the first 1000 results to find the online support groups that meet the following criteria: 1) cancer related; 2) include a discussion forum; and 3) have been active in the past 8 weeks. Communities that are for caregivers are not included in the study. Overall, 40 communities were identified, among which we were permitted to recruit participants for the study from two of the communities. Then, we posted a description of the study and a link to the online questionnaire in the two communities. A small compensation was given to the participants for joining in the study.

Sample

A total of 386 participants were included in the study. The age of the participants ranged between 22 and 83 (M=39.8 years, SD = 9.0). Incomplete responses and duplicated IP address were excluded from the study. Most of the participants were White/Caucasian (77.3%), followed by Hispanic/Latino (9.0%), Asian (6.6%), African American (4.9%), and two or more ethnicities (0.2%). 48.7% of the participants had a Bachelor's degree, followed by some college (31.8%), high school education or less (12.0%), and an advanced degree (5.1%). 86% of the participants were married. 0.5% of the participants were in cancer stage 0, 26.2% were in stage 1, 46.9% were in stage 2, 20.0% were in stage 3, and 3.0% were in stage 4. Participants had various cancers, including breast cancer ($n = 87$), prostate cancer ($n = 102$), skin cancer ($n = 39$), colorectal cancer ($n = 46$), lung and bronchus cancer ($n = 50$), thyroid cancer ($n = 40$), bladder

14

and kidney cancer ($n = 26$), and others. The participants must have been using the online health support groups for at least 6 months.

Measures

Offline Network Diversity

A question asked the participants to name up to 12 contacts who they first met in the offline world and who they have gone to for help in the past 6 months. After they input their contacts' first names or last initials, they were asked to identify specific relationship types they had with each contact (i.e., immediate kin, partner).

To measure the offline network diversity, an exploratory factor analysis was conducted first to capture the major categories of relational ties mentioned in the offline support networks. Blau's index (Blau, 1977) was used next to calculate the diversity of the offline support networks. It is expressed as $D' = (1 - \sum p_i^2)$, where P is the portion of individuals belongs to the ith category of offline relationships (Blau, 1977).

Online Network Diversity

A similar question asked participants to name up to 12 contacts that they first met in online health support groups and who they have sought support from in the past 6 months. Participants were also asked to report the relational ties they have with their online contacts.

To describe the composition of people's online support networks, an exploratory factor analysis was used to find the major categories of the relational ties mentioned in online support networks. We then used Blau's diversity index (Blau, 1977) to compute diversity of online support network. $D' = (1 - \sum p_i^2)$. Where P is the portion of individuals belongs to the ith category of offline relationships (Blau, 1977).

Online Received Social Support

15

Online received social support was measured by the actual level of support that one receives from others from their online support networks. The experienced social support scale (Xu & Burleson, 2001) was used to measure received social support. A 5-point scale was used to rate how much support that the participants received (1 = Didn't received at all to 5 = Received all the time) in the last 6 months related to their cancer conditions. The support items assessed five different types of support, including informational, emotional, esteem, tangible, and network support. The 5-dimension measure of the overall received social support had a Cronbach's alpha of 0.95.

Use of Online Support Groups

Media Use in the online support groups was measured by participants' use of the online health support groups. They were asked about how long they had been a member of the online support groups, and how many times per week they logged in the online support group in the past 6 months (Boulianne, 2015; Tsai & Bagozzi, 2014).

Analytical Plan

Ordinary Least Squares (OLS) regression was used to test the relationship between diversity of online support network and the received social support. Moreover, we examined the relationship between participation in online support groups and one's received social support from online health support networks. Hierarchical regression was used to investigate whether social enhancement theory or social compensation theory is more plausible to explain the moderating effect of the offline network diversity on the relationship between media use and online received support.

RESULTS

Descriptive Measure of the Diversity of Online Network

For online support networks, the factorability of the 11 online relationship types gathered from the 386 participants was examined. The Kaiser-Meyer-Olkin measure of sampling adequacy was .792, indicating the proportion of variance in the variables might be caused be underlying factors. Barlett's test of sphericity was significant ($\chi^2 (386) = 1004.91$, $p < 0.05$), indicating the variables are unrelated and suitable for structure detection. Thus, factorial analysis was deemed to be suitable for all 11 items.

Table 1
Factor Analysis Table for Different Online Relationships

	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Romantic Partner	**.862**	-.007	.018	.054	.746
Neighbor	**.799**	-.021	.090	.037	.649
Immediate Kin	**.688**	-.013	-.103	-.128	.501
Co-worker	**.684**	-.044	.115	.090	.491
Other Relatives	**.632**	-.021	.143	.208	.464
Helping professional	**.623**	.208	.210	-.216	.522
Club Member	.042	**.813**	.286	-.118	.759
Other Acquaintance	-.075	**.780**	-.295	.175	.733
Friend	-.036	-.145	**.780**	.107	.642
Peer	.299	.224	**.712**	-.014	.647
Stranger	.065	.040	.084	**.930**	.878
Eigenvalue	3.372	1.402	1.234	1.022	
% of Total Variance	30.655	12.745	11.217	9.287	
Total Variance				63.904	

N=386

The Varimax rotation results of the factor analysis solution for different online relational ties are shown in Table 1. The analysis yielded 4 factors explaining a total of 63.90% of the variance of the entire set of variables. Factor 1 was the reflection of people's offline relationships due to the high loadings by the following relationships: romantic partner, neighbor, immediate kin, co-worker, helping professional, and other relatives. The first factor explained 30.66% of the variance. The second factor captured 'online similar others' due to the high loadings of other

acquaintance and club member. The variance explained by this factor was 12.75%. The third

factor was online friend due to the high loadings of peer and friend. The third factor explained

11.22% of the variance. The fourth factor was stranger, which explained 9.29% of the variance.

Substantively, these results mean that we have identified 4 patterns of online relationships.

From the results of the factorial analysis for online support network, online relational ties

are diverse. Factor 1 captures the reflection of the cancer patients' offline ties who also

participate in their online support networks, including the major strong ties of the cancer patients.

Relational ties that load on Factor 1 were only nominated by a small number of participants (i.e.

only 5% participants nominated other relatives, and 6% participants nominated romantic

partners). 11 participants nominated one immediate kin that they first met online and 2

participants nominated 2 immediate kin that s/he first met online. These situations were very

unlikely to happen. Thus, people who nominated immediate kin that they first met online were

excluded from the further analysis. Factor 2, Factor 3, and Factor 4 capture the different

dimensions of cancer patients' online relationships in their online health support groups. Among

all the relational ties, club members and friends were nominated by the greatest number of

participants. 30% of them nominated at least one club member in their online support networks;

29% of them nominated at least one friend in their online support networks. Club members and

friends load high on Factor 2 and Factor 3 respectively, indicating they are different but

important aspects of people's online relationships. Though most of them are weak ties, the

relationships of online ties are diverse. Thus, considering online ties as weak ties can lead to

overlooking the importance of online networks diversity. This diversity of the online weak ties is

more obvious if we compare the results of the factorial analysis of online network with the

offline network (Table 2).

For the exploratory factorial analysis for the relational ties in offline support network, the Kaiser-Meyer-Olkin measure of sampling adequacy was .625, indicating the proportion of variance in the variables might be caused be underlying factors. Barlett's test of sphericity was significant ($\chi^2(386)$＝575.734, p < 0.05), indicating the variables are unrelated and suitable for structure detection. Thus, factor analysis was deemed to be suitable for all the 11 items.

Table 2
Factor Analysis Table for Different Offline Relationships

	Factor 1	Factor 2	Factor 3	Factor 4	Communality
Romantic Partner	**.785**	.178	-.002	.124	.663
Immediate Kin	**.760**	-.050	-.028	-.137	.600
Other Relatives	**.735**	-.072	.034	.081	.553
Peer	-.161	**.704**	.031	.139	.541
Friend	.239	**.651**	.246	-.021	.542
Co-worker	-.028	**.614**	-.158	.204	.444
Stranger	-.091	.064	**.789**	.049	.637
Other Acquaintance	.043	-.151	**.589**	.456	.579
Neighbors	.266	.499	**.532**	-.286	.684
Helping Professional	.022	.153	-.085	**.767**	.619
Club Member	.044	.166	.339	**.625**	.536
Eigenvalue	2.268	1.760	1.249	1.120	
% of Total Variance	20.621	16.001	11.353	10.184	
Total Variance				58.159	

N=386

The Varimax rotation results of the factor analysis solution for different offline relational ties are shown in Table 2. The analysis yielded 4 factors explaining a total of 58.159% of the variance of the entire set of variables. Factor 1 was the reflection of people's offline strong ties due to the high loadings by romantic partner, immediate kin, and other relatives. The first factor explained 20.62% of the variance. The second factor was offline friends due to the high loadings of peer, friend, and co-worker. The variance explained by this factor was 16.00%. The third factor was offline weak ties due to the high loadings of stranger, other acquaintance, and neighbors. The third factor explained 11.35% of the variance. The fourth factor was helping professional and club member, which explained 10.18% of the variance. Among all the

participants, 48% of them nominated at least one romantic partner, followed by 38% of them

nominating at least one friend, and 26% of them nominating at least one immediate kin in their

offline support networks. Substantively, these results mean that we have identified 4 patterns of

offline relationships.

Comparing the results of factorial analysis for online relationship with offline

relationship, different relational ties of offline support network are loaded into 4 factors based on

their relational features. While for online support network, factor 1 captures all the offline ties

that also participate in the cancer patients online support networks. Factor 2, Factor 3, and Factor

4 of online support network are all loaded by different kinds of relational ties, indicating

relational ties in online support network are not homogeneous. Rather, the diversity of the online

ties might be important for the cancer patients' online received support.

Online Network Diversity and Online Received Support

OLS Regression was conducted to test the relationship between the diversity of online

support network and the online received social support (Table 3). The results of the regression

indicate that online network diversity significantly predicts online received support ($\beta = .20$,

p<0.001).

Table 3
OLS Regression Results for Online Diversity and Online Received Support

Variable	B (SE)	Beta
Sex	.213(.109)	.106
Ethnicity	-.065(.049)	-.069
Age	.001(.006)	.014
Cancer Stage	.075(.057)	.080
Days	.015(.035)	.026
Membership	.108(.035)	.176**
Online Network Size	.004(.028)	.010
Online Density	1.700(.211)	.561***
Online Diversity	.669(.188)	.197***
Constant	.745(.373)*	
R^2	.427***	

Table 3 (cont'd)

N	229

*** $p < 0.001$; **$p < 0.01$; * $p< 0.05$

The relationships between online network diversity and all dimensions of online received

support were also measured. The results show that online network diversity positively predict

emotional support ($\beta = .19$, $p < 0.01$), esteem support ($\beta = .19$, $p < 0.01$), network support (β

$= .13$, $p < 0.05$), informational support ($\beta = .15$, $p < 0.05$), and tangible support ($\beta = .20$, $p <$

0.001).

The Moderating Effect of Offline Network Diversity on Media Use and Online Received

Support

Table 4
Table of Hierarchical Regression Analysis

Variable	Model 1		Model2		Model3		Model4	
	B (SE)	Beta	B (SE)	Beta	B (SE)	Beta	B (SE)	Beta
Sex	.342 (.115)	.164 **	.270 (.116)	.129 *	.260 (.115)	.124 *	.351 (.117)	.168 *
Age	.006 (.006)	.063	.003 (.006)	.027	.001 (.006)	.012	.001 (.006)	.013
Ethnicity	-.051 (.053)	-.052	-.049 (.052)	-.049	-.050 (.052)	-.051	-.043 (.052)	-.044
Cancer Stage	.010 (.059)	.010	.045 (.061)	.046	.028 (.061)	.029	.032 (.062)	.033
OnDegree	.000 (.029)	.000	.005 (.029)	.013	-.001 (.029)	-.002	.023 (.029)	.054
OnDensity	1.723 (.214)	.560 ***	1.694 (.215)	.551 ***	1.690 (.214)	.550 ***	1.732 (.211)	.563 ***
OnDiversity	.611 (.191)	.177 **	.611 (.193)	.177 **	.529 (.197)	.153 **	.560 (.193)	.162 **
Membership			.110 (.036)	.176 **	.123 (.036)	.197 **	.109 (.036)	.176 **
Days			-.001 (.038)	-.001	.001 (.037)	.002	.002 (.037)	.004
OffDiversity					.368 (.196)	.110	.129 (.208)	.039
Mmb×OffDiv							-.436 (.144)	-.176 **

Table 4 (cont'd)

|					
Days×OffDiv				-.156	-.066
				(.130)	
Constant	0.865	1.041	1.212	.932	
	(.346)	(.359)	(.368)	(.370)	
	*	**	**	*	
R^2	.408	.436	.445	.475	
ΔR^2	.408	.028	.009	.030	
F Value	20.394	17.577	16.368	15.233	
	***	***	***	***	

N=215; *** $p < 0.001$; **$p < 0.01$; * $p < 0.05$
*Variables added to Regression model 2, 3, 4 were centralized

A four-stage hierarchical multiple regression was conducted with online received social support as the dependent variable. Online network density, online network diversity, cancer stage, and demographic variables were at stage one of the regression as control variables. Demographic variables include age, sex, and ethnicity. The independent variable online participation (days and membership) were entered at stage two. The offline diversity was entered in stage three, and the variables of the interacting effect of offline diversity and online participation were entered in stage four. The regression statistics are in Table 4.

The hierarchical multiple regression revealed that, at stage one, the online network size, online density, online diversity, and the demographic variables contributed significantly to the regression model F (7, 207) = 20.39, $p < 0.001$) and accounted for 40.8% of the variation in online received support. Introducing the participation variables explained an additional 2.8% of the variation in online received social support, and this change in R^2 was significant, F (9, 205) = 17.58, $p < 0.001$. Adding offline diversity to the regression model explained an additional 0.9% of the variation in online received social support, and this change in R^2 was significant, F (10, 204) = 16.37, $p < 0.001$. Finally, the addition of the interaction variable of offline diversity and online participation explained an additional 3% of the variation in online received social support,

and this change in R^2 was also significant, $F (12, 202) = 15.23$, $p < 0.001$. Together, all the independent variables accounted for 50.3% of the variance in online received social support.

Figure 2
Moderating Effects of Offline Diversity
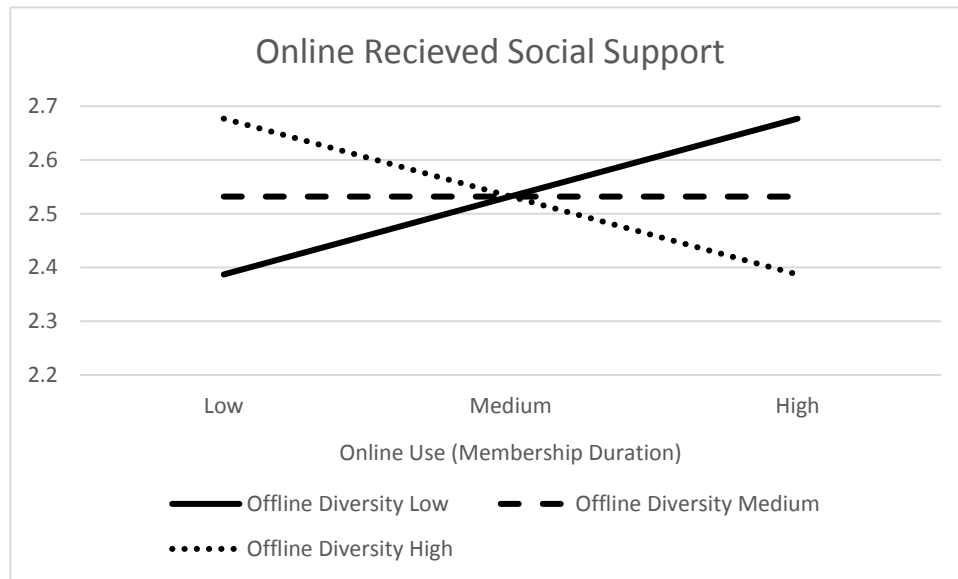
Offline diversity was examined as a moderator of the relationship between online participation and online received social support. The results (Figure 1) showed that when people's offline network diversity is high, their membership duration of the online health support groups is negatively related to their online received social support; when their offline network diversity is low, their membership duration of the online health support groups is positively related to their online received social support. Offline diversity was a significant moderator of the relationship between membership duration and online received social support. While the moderating effect of offline network diversity on the relationship of the frequency of the online group usage and the online received social support was not significant.

DISCUSSION

This study provides some new findings of the factors that influence one's received social support from online support networks. Network features are important to online social support, while less attention has been paid to the diversity of online networks. Traditionally, relational ties in one's online networks are viewed as homogeneous weak ties. While under the broad concept of weak ties, the relationship types between egos and alters in online support networks can be diverse.

From the descriptive measures, we found that club members and friends were nominated by the greatest amounts of participants as the relational ties that they had with their alters in the online support networks, indicating that they are the major compositions of people's online support networks. The exploratory factorial analysis identified four patterns of online relational ties, except one factor reflecting people's offline relationships, other three factors showed the diversity of the relational ties people have in their online support networks.

The study found a positive relationship between the diversity of online support networks and the received social support. A more diverse online support network predicted more received emotional support, esteem support, network support, informational support, tangible support, and the overall online received support. Thus, we can say that the diversity of online support networks is also conceptually important in understanding the online network features and its relationship to received social support.

To investigate the influence of the network diversity on people's received social network, only focusing on online networks is not enough. Online networks and offline networks are interdependent on each other. People's offline network structure can be a factor that influences people's online received social support. This research found that people's offline network

diversity moderates the relationship of the use of the online support groups and the received social support. The moderating effect of the offline network diversity on the relationship of participants' membership duration and online received social support was significant. When people's offline network diversity is high, their membership duration of the online health support groups is negatively related to their online received social support; when their offline network diversity is low, their membership duration of the online health support groups is positively related to their online received social support. The moderating effect of offline network diversity on the relationship of the frequency of the online group usage and the online received social support was not significant. This could be because the limitations of the frequency measure on the online health support group usage.

We investigated the factors that may affect people's online received support from the aspects of media use and the online network structure. The diversity of the online support networks is the focus of this study. Online diversity of support networks is an important concept that deserves more attention. It not only indicates the potential social support resources in the online networks but also highly relates to one's offline networks and the overall social support.

LIMITATION AND FUTURE WORK

This study has several limitations. First, the measurement of media usage can be improved. This study measured the participation in online support groups from the aspects of frequency and membership duration. Frequency was measured by asking participants the average number of days in a week that they use the blogs where they accessed the link to this survey. This measure can be improved and made more accurate to capture the frequency of the online platform usage.

Second, this study is a cross-sectional study that only analyzed the data at a specific time point. Causal relationships cannot be concluded from the study. In the future, longitudinal studies are expected to investigate the causal relationships of network diversity, media use, and their relationships to the received social support.

Third, the sample of this study was recruited from two online communities. It cannot represent all cancer patients or all media users who seek health-related support online. So, the results of the study cannot be generalized to a broader population.

This study points out the importance of the concept of online network diversity. More research about the impacts of online diversity is expected. Online networks and offline networks are interdependent. This research tests the moderating effects of offline diversity on media usage and online received social support. It is natural to further test how offline diversity moderates the relationship between online diversity and online received social support. Around the concept of network diversity, studies can be conducted in both online and offline environments.

Regarding that online diversity is an important factor for cancer patients' received social support, innovations and experimental research about increasing the diversity of online health

support networks are expected. These studies will be valuable to cancer patients as well as to the

general population.

APPENDIX

Online and Offline Network Diversity and Social Support Questionnaire

1. Please name *up to* 12 offline contacts that you have gone to for help with your cancer-related condition in the past 6 months (you do not have to provide 12 contacts if you do not have that many). The contacts that you provide must be the ones who you first met and primarily interact in the offline world (i.e., face-to-face). The person could be your family, friends, coworkers and acquaintances etc. After you input the first names and last initials of those contacts, please choose from the dropdown box to indicate what type of relationship that you have with each contact (choose all that apply).

Contact	First name. Last initial (e.g., Andy. S.)	Relationship
Contact 1		
Contact 2		
Contact 3		
…		
Contact 12		

[Dropdown items for relationship]

- Immediate kin (including parents, siblings, children)

- Non-immediate kin (relatives other than immediate kin, including aunts, uncles, cousins, etc.)

- Romantic partners (including spouse, boyfriends/girlfriends/fiancés)

- Friends

- Peers (i.e., someone who has or has had cancer)

- Acquaintances

- Strangers

- Neighbors

- Co-workers

- Helping professionals

- Member of same group or club

- Other

2. [Name generator] Please name *up to* 12 online contacts that you have gone to for help

   with your cancer-related condition in the past 6 months (you do not have to provide 12

   contacts if you do not have as many). The contacts that you provide must be the ones who

   you first met and primarily interact in the online world. The person could be someone

   who you met from a Facebook group, an online community, or a blog etc. If you do not

   know their real names, simply write their screen names in the virtual world. After you

   input the names of those contacts, please choose from the dropdown box to indicate what

   type of relationship that you have with each contact (choose all that apply).

Contact	First name. Last initial or Screen name (e.g.,	Relationship
Contact 1		
Contact 2		
Contact 3		
…		
Contact 12		

[Dropdown items for relationship]

- Friends

- Peers (i.e., someone who has or has had cancer)

- Acquaintances

- Strangers

- Immediate kin (including parents, siblings, children)

- Non-immediate kin (relatives other than immediate kin, including aunts, uncles, cousins, etc.)

- Romantic partners (including spouse, boyfriends/girlfriends/fiancés)

- Neighbors

- Co-workers

- Helping professionals

- Member of same group or club

- Other

3. Do you belong to one or more of the following *offline* groups or organizations?

- Religious groups

- Job-related associations

- Recreational groups

- Civic-political groups

- Health-related groups

- Other groups

4. Do you belong to one or more of the following *online* groups or organizations?

- Religious groups

- Job-related associations

- Recreational groups

- Civic-political groups

- Health-related groups

- Other groups

5. Experienced Support (Xu & Burleson, 2001).

Directions: Your offline (i.e., people you first met face-to-face) [online (i.e., people you first met online] social relationships may do all kinds of different things for you when you need support related to your cancer-related condition, but they probably do so to a greater or lesser extent. Here, we are interested in *how much of each behavior you have actually received* [*how much of each behavior you felt was available*] from your offline [online] social relationships in the past 6 months. Obviously there are no right or wrong answers. For each of the numbered items below, please use the following scale to report *how much of each behavior you actually received [felt was available]* from your offline social relationship [online social relationships] during the previous 6 months. Please use the following scale in responding to each item:

Received Support Scale

- A. Didn't Receive at All
- B. Received Rarely
- C. Received Occasionally
- D. Received Regularly
- E. Received All the Time

Emotional Support Items

- Expressing understanding of a situation involving your cancer-related condition that is bothering you, or disclosing a similar situation that he/she experienced before
- Comforting you when you are upset about your cancer-related condition by showing some physical affection (including hugs, hand-holding, shoulder patting, etc.)

- Providing you with hope or confidence about your cancer-related condition

Esteem Support Items

- Expressing esteem or respect for a competency or personal quality of yours involving to your cancer-related condition

- Telling you that you are still a good person even when you have a problem involving to your cancer-related condition

- Assuring you that, regardless of your cancer-related condition, you are a worthwhile person

Network Support Items

- Connecting you with people whom you may turn to for help with your cancer-related condition

- Offering to spend time with you to get your mind off your cancer-related (chatting, having dinner together, going to a concert, etc.)

- Helping you find the people who can assist you with things involving your cancer-related condition

Informational Support Items

- Giving you advice about what to do regarding your cancer-related condition

- Helping you to analyzing a situation involving your cancer-related condition and telling you about available choices and options

- Providing detailed information about a situation related to your cancer-related condition or about skills needed to deal with the situation

Tangible Support Items

- Taking you to see a doctor for your cancer-related condition when you don't feel well

- Taking care of your domestic chores when you are feeling ill due to your cancer-related condition

- Offering to help you do something that needs to be done involving to your cancer-related condition

6. In which year were you born?

7. Please indicate your sex.

   - Male

   - Female

   - Other

8. Please indicate your ethnicity.

   - White/Caucasian

   - Hispanic/Latino

   - Black/African American

   - Asian

   - Two or more ethnicities

   - Other

9. Please indicate your marital status.

   - Single/Never married

   - Married

   - Divorced

   - Widowed

   - Separated

   - Other

10. What is the highest level of education you have completed?

- Less than high school

- High school graduate

- Some college

- Bachelor's degree

- Advanced degree

11. Please indicate your cancer stage.

- Stage 0

- Stage I

- Stage II

- Stage III

- Stage V

- I don't know.

12. Please provide your cancer type (you can choose multiple types if necessary).

- Breast

- Prostate (Males only)

- Skin/Melanoma

- Colon/Rectal

- Bladder/Kidney/Genitourinary

- Leukemia/Lymphoma

- Thyroid

- Lung/Bronchus

- Head/Neck

- Overfan (Females only)

- Uterus (Females only)

- Cervix (Females only)

- Pancreas

- Gastrointestinal/Stomach

- Other

13. Questions on this page will ask your time spent in the blog where you accessed the link to this survey:

Number of days per week?

- 1 day

- 2 days

- 3 days

- 4 days

- 5 days

- 6 days

- 7 days

Number of hours per session?

- Less than 30 minutes (0.5 hours)

- 30 minutes (0.5 hours) to 1 hour

- 1hour to 1.5 hours

- 1.5 hours to 2 hours

- 2 hours to 2.5 hours

- 2.5 hours to 3hours

- More than 3 hours

How long have you been a member of the blog where you accessed the link to this survey?

- Less than a year

- 1 to 2 years

- 2 to 3 years

- 3 to 4 years

- 4 to 5 years

- 5 to 10 years

- Over 10 years

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