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Recommended Citation

Welbourne, J. L., Blanchard, A. L., & Boughton, M. D. (2009, June). Supportive communication, sense of virtual community and health outcomes in online infertility groups. In Proceedings of the fourth international conference on Communities and technologies (pp. 31-40).

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Supportive Communication, Sense of Virtual Community and Health Outcomes in Online Infertility Groups

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ABSTRACT

Women are turning to online health groups to deal with the stresses and complications of infertility. Online groups may provide a resource that is potentially absent in their face-to-face communities. This study examines how the sense of virtual community (SOVC) that develops in these groups serves as a buffer between perceived stress and physical health symptoms. A sample of 122 women from two virtual communities completed an online survey. Results show that observing the exchange of emotional support was positively related to SOVC while observing informational support was negatively related to SOVC. Further, SOVC was negatively related to physical health symptoms and additionally, served as a buffer between stress and physical health symptoms. Implications for SOVC and virtual health community research are discussed.

Categories and Subject Descriptors

J.4 SOCIAL AND BEHAVIORAL SCIENCES; Psychology; Sociology

General Terms

Management, Design

Keywords

Online communities, virtual community, online healthcare groups, health outcomes, sense of virtual community

1. INTRODUCTION

The American Society for Reproductive Medicine reports that 10% of American couples experience infertility during their reproductive years, which can lead to depression, anxiety, relationship strain, and other psychosocial problems [13]. In addition, more American women are waiting until after the age of 35 to start trying to have children, an age at which fertility decreases and problem pregnancies increase. Thus, there is an increasing and significant number of American women who are experiencing infertility problems.

One source of support for women experiencing infertility problems is online support groups, or virtual communities. Infertility problems are not obvious; it is impossible to look at

someone to determine whether she is experiencing infertility. Therefore, women may not be able to easily identify support in their face-to-face (FtF) communities. There are, however, many online communities which provide support for women suffering from infertility. For example, Yahoo groups alone has 699 groups dedicated to women with infertility problems.

The increasing prevalence of infertility, coupled with the lack of traditional support outlets, underscores the importance of investigating the role of online (or virtual) support groups as a source of emotional and informational benefits. Our objectives in this project are to identify the psychosocial benefits that occur for women who participate in virtual infertility support groups and to identify the mechanisms through which they occur. In particular, we suggest that providing, receiving, and observing the exchange of online informational and emotional support leads to an increased sense of virtual community among the virtual community members. Further, we suggest that sense of virtual community moderates the relationship between stress and physical health symptoms experienced by group members. Specifically, we propose that sense of virtual community provides a buffering effect against stress, such that among group members who report high levels of perceived stress, those with a strong sense of virtual community will experience fewer physical health symptoms than those with a weaker sense of virtual community.

In this article, we will first provide an overview of the research literature on virtual health communities; specifically, we will examine the benefits of providing, receiving, and exchanging informational and emotional support in virtual health communities. Second, we will introduce the construct of *sense of virtual community* and discuss its potential relationship with supportive communication in virtual health communities and its role in buffering the negative effects of stress on health symptoms. We will then present data from two virtual health communities focusing on infertility issues to test our hypotheses.

2. THE INCREASING ROLE OF VIRTUAL HEALTH COMMUNITIES

Virtual communities are a growing source of informational and emotional support for individuals dealing with health concerns. Indeed, virtual support groups may provide several benefits that are not as easily attainable through FtF support groups. For example, virtual communities can overcome temporal or geographic boundaries that FtF groups cannot. In virtual communities, support is available at any time the individual seeks

it, and the network of support can extend far beyond the individual's locale [6, 22, 50, 54, 55]. The increased heterogeneity of the support network can also facilitate a broader spectrum of information and perspectives.

Additionally, individuals may feel more comfortable confiding personal information in a virtual community, where there is some degree of separation from their FtF networks. They can confide their feelings to and obtain support from similar others. Important others from their offline networks may not be comfortable or even able to provide this support. For these reasons, the number of people seeking health-related support from virtual communities has grown dramatically in recent years.

2.1 Supportive Communication in Virtual Health Communities

Participation in virtual health communities provides members with numerous opportunities for supportive communication. For example, members may exchange information about treatments or symptoms, they may express empathy or encouragement, acknowledge or validate the feelings and opinions of other group members, or share their own experiences and perspectives [19, 23, 38]. Research studies that have systematically coded message postings in virtual health communities indicate that sharing emotional support and informational support are two of the most common ways in which community members communicate with one another. Emotional support includes expressions of empathy and encouragement related to health concerns [33], while informational support can involve providing facts, health-related sources or references (such as books or websites), advice, and suggested courses of action or treatment [33].

Exchange of informational support is very prevalent in virtual health communities. Indeed, one advantage of virtual communities is that in addition to receiving general information on a health issue, members are able to seek and obtain more specialized information by participating on specific boards or threads on a particular topic [58]. For example, women who are using Clomid to address ovulation problems can discuss their experiences with this prescription drug with others. In another type of virtual health community, Coulson [19] found that messages posted by members of an irritable bowel syndrome support group focused primarily on providing informational support, such as educating others how to interpret and manage their symptoms. Similarly, on a virtual health community for problem drinkers, approximately 37% of posts focused on providing information and advice [23]. Other studies indicate that exchange of information is an important aspect of supportive communication in virtual health communities relating to breast cancer [45], functioning with disabilities [8], and hearing loss [23].

Exchange of emotional support also occurs frequently on virtual health communities. In a review of 100 virtual health communities, Preece and Ghazati [42] found that emotional support was the most frequent type of support exchanged among community members. To illustrate, the majority of communication in a virtual community for disabled persons focused on emotional support [8]. Also among problem drinkers who participated in a virtual community, almost 30% of messages focused on providing emotional support to other community members (Klaw et al., 2000). Interestingly, some evidence

indicates that the emphasis on emotional versus informational support may vary depending on the type of health issue focused upon; for instance, one study found that members of breast cancer virtual discussion groups were more likely to seek and provide emotional support, while members of a prostate cancer discussion group were more likely to seek and provide informational support [39]. Of course, this could also reflect the nature of gender in online groups which shows that women are more likely to engage in emotional support exchanges than men [27, 47].

2.2 Psychosocial benefits of supportive communication in virtual communities

There are many ways in which the supportive communication that occurs in virtual health communities can benefit members. Previous work primarily documents the benefits of active participation in virtual health communities (i.e., posting messages to the group). Rodgers and Chen [45] found that women who posted more messages to an online breast cancer group showed greater improvement in mood compared to those who posted less. Similarly, another study examining a virtual community for women with breast cancer found that women who posted messages that focused on gaining insight into their struggle with breast cancer showed enhanced wellbeing and decreased negative mood [49]. These studies suggest that active participation in virtual health communities can have positive psychosocial outcomes. These findings are also consistent with psychological research demonstrating the benefits of writing and disclosure for dealing with stressful issues or trauma [41].

Directly receiving messages of support has also been linked to positive outcomes for virtual health community members. For instance, both posting *and* receiving replies to one's posts predicted lower levels of distress among members of a virtual community for severely distressed or suicidal adolescents [2]. Similarly, Wright [57] found that members of a cancer virtual community who perceived receiving more emotional support from the community also reported lower levels of stress. These findings are consistent with the extensive literature demonstrating that receiving support (in non-virtual settings) increases positive psychosocial outcomes [e.g., 11, 29, 52].

In addition to providing and receiving support, members can also observe the exchange of support among others [5, 7, 54]. Although prior research has examined the positive outcomes that result from providing support to or receiving support from community members, there has been less emphasis on examining the potential benefits of simply observing the exchanging of support within the community. Still, Wellman and Guilia [54] have pointed out that in online groups, everyone observes the exchange of support benefits, not just the active participants. Indeed, receptive participants (i.e., "lurkers"), who read posted exchanges between others, but do not actively participate by posting messages or receiving responses themselves, may make up the majority of online group participants with estimates ranging from 55% to 90% of online group membership [7, 43]. Nonetheless, past research has focused almost exclusively on active participation in computer support groups; much less attention has been focused on the potential benefits of receptive participation. This approach is lacking in that it ignores the sheer number of receptive participants involved in virtual communities.

Therefore, one goal of the current study is to examine positive outcomes associated with observing supportive communication among virtual community members, in addition to benefits associated with more active involvement in the community.

3. SENSE OF VIRTUAL COMMUNITY

One potential benefit that has not been previously examined is the resulting sense of community that may arise from giving, receiving, and observing the exchange of support in virtual health communities. Indeed, Wright and Bell [58] suggest that one motivation for joining virtual health communities may be a desire to develop a sense of community with others who share similar conditions or concerns. They go on to observe that developing an understanding of how sense of community is related to beneficial health and psychosocial outcomes is a needed direction for virtual community research [58].

Researchers have recently begun to examine how a sense of community might unfold in virtual settings, coining the term Sense of Virtual Community (SOVC) to capture the features of community that are unique to online settings. SOVC is defined as members' feelings of identity, belonging and attachment with others in their online group [7]. In the current research, we examine the relationship between supportive communication and sense of virtual community in health communities, and further, whether sense of virtual community is associated with subsequent positive health outcomes.

3.1 SOVC and Supportive Communication

While the link between supportive communication and SOVC has not been explicitly tested in virtual health communities, some initial evidence suggests an association between these constructs. For example, active participation in posting and reading messages in an online support group for hearing loss was associated with greater community orientation, as measured by feelings of being part of the group [23]. Additionally, previous research has shown an initial link between both observing and exchanging support and SOVC in non-health related virtual communities [5, 7, 34]. Indeed, even in FtF communities, exchanging support is consistently and strongly related to sense of community [9, 12, 48, 59].

In virtual health communities, attention has focused not only on exchanging support, but also on the types of supportive communication exchanged. As we have discussed previously, informational and emotional communication are important forms of the support exchanged in these communities. Although previous research on SOVC has not broken the types of support into informational and emotional support, we believe both forms will be important in the development of a SOVC. We base this argument on social exchange theory. Social exchange theory is one of the fundamental theories for understanding behavior between individuals and within groups. It explains why people help each other, and why they exchange information, support, and love among other commodities [21]. Social exchange theory is based on the near universal norm of reciprocity [28]. This reciprocity can either be direct, as in the help exchanged between two people, or indirect when help is exchanged with an entire group [26].

Social exchange theory argues that people's affective attachment is governed by the entity with which they are exchanging support

[26]. That is, if the exchange is dyadic, the attachment remains between the two social exchange partners. But if the exchange occurs indirectly within a group (as is the case in virtual communities), the attachment is to the group. In virtual health communities, the main commodity exchanged is informational and emotional support. Therefore, we suggest that the exchange of these commodities within the community will result in positive attachment to the community. More specifically, we hypothesize the following:

Hypothesis 1: Posting, receiving, and observing the exchange of informational and emotional support in a virtual health community will be associated with SOVC.

3.2 SOVC and Health Outcomes

Although SOVC is a relatively new construct, it is expected to be related to positive outcomes for virtual communities. One source of evidence for our argument comes from research on sense of community in FtF groups. Sense of community in FtF communities is regarded quite positively, to the point of being considered an essential feature of well-functioning, healthy communities [36, 37, 46]. Sense of community is desired because it leads to satisfaction with and commitment to the community [9], and is associated with involvement in community activities and problem-focused coping behavior [37]. Although SOVC as a component of virtual communities has not been widely examined, initial examinations have considered it to be a desirable feature of online groups, as well, and speculate that it will have positive outcomes [7, 34, 44]. Therefore, we suggest that SOVC should be related to positive outcomes in virtual health communities.

Specifically, we posit that SOVC should be related to positive health outcomes. Again, we start our argument by noting that sense of community is positively related to health outcomes in FtF communities. For example, sense of community has been related to lower stress for firefighters [20]. Additionally, sense of community among neighbors improves residents' well-being [24] and increased palliative care patients' quality of life [31]. Finally, sense of community for volunteers and employees of an eldercare facility improved their experiences and decreased stress [25]. Therefore, we suggest that similar to the health benefits that sense of community provides in FtF communities, SOVC will also be related to positive health outcomes.

In particular, we suggest that SOVC will be associated with fewer physical health symptoms, and that it will have a buffering effect on the relationship between stress and physical health symptoms for participants in virtual health communities. The outline for our rationale follows. In the current research, which focuses on members of a virtual community on infertility issues, we suggest that women who are dealing with the health issue of infertility are likely to experience increased levels of stress [13].

A multitude of past research has associated stress with poor physical health. High levels of perceived stress have been linked to greater vulnerability to infectious diseases [see 32]. For example, individuals reporting greater levels of stress were more likely to catch a cold when exposed to the virus [15, 16]. Studies have also indicated that stress can delay the healing of wounds [35]. Additionally, Cohen, Kamarck, and Mermelstein [14] demonstrated that participants who reported higher levels of perceived stress also reported more physical health symptoms. Essentially, this body of research has suggested that exposure to

high levels of stress impairs immune functioning, leading to poorer health outcomes [10].

While stress has been associated with poorer health, participation in social networks has been associated with improved health. People with strong social networks have lower onset of and quicker recovery from illness [56]. They also have lower mortality rates [3, 30]. The stress-buffering model [17] suggests that social networks exert a positive influence on health outcomes primarily for individuals who are experiencing high levels of stress. This model, which has gained much support [see 17], proposes that participation in social networks allows individuals to cope better with stress, buffering the negative impact of stress on health outcomes. Because virtual communities, including virtual health communities, are essentially online social networks, we feel this research is particularly appropriate here [18, 53, 55]. In addition, Taylor and her colleagues [51] highlight the importance of social networks for women, like those in online infertility groups, in coping with stress. These researchers propose that women undergoing stressful situations are more likely to engage in a “tend and befriend” response, in which they create social networks (often with other women) to provide protection from threats [51].

In the current study, we propose that SOVC will be associated with fewer physical health symptoms, and more specifically, that it will provide a buffer against the detrimental effects of stress on health experienced by virtual community members. As previously defined, SOVC encompasses feelings of attachment, identity, and belonging to a group [7]. As such, we suggest that feeling that one is part of a supportive community will offer the positive stress-buffering effects that have been associated with FtF social networks. Therefore, in the current research, we hypothesize that:

Hypothesis 2: Perceived stress will be associated with greater physical health symptoms.

Hypothesis 3: SOVC will be associated with fewer physical health symptoms

Hypothesis 4: SOVC will interact with perceived stress to influence physical health symptoms, such that SOVC will buffer the effects of high levels of stress on physical health symptoms.

4. METHOD

4.1 Research Context

Infertility groups are somewhat different than other virtual health communities. Like online health communities focused on diseases such as cancer, the ultimate goal is to not have the health problem anymore. However, unlike disease-based online health communities, members of online infertility groups have at least some possibility of successfully graduating from the group every month.

This may lead to a different rhythm of interaction for individual members and perhaps the entire community as compared to other online health communities. For example, members of online infertility groups often track two important times during the month: ovulation and, two weeks later, pregnancy testing. Much communication in these online infertility groups revolves around these two points of time. In other online health groups, important treatment and testing times (e.g., chemotherapy and subsequent

cancer testing) may be more spread out or may not occur at all (e.g., lifelong coping with asthma or diabetes).

While we note the differences of different types of online health communities, we do not believe that they limit the basic generalizability of our model. We, nonetheless, feel it is important to note for other researchers to consider.

4.1 Participants and Procedure

Participants were 122 women, who were recruited from two virtual communities (one regional and one national) for women dealing with infertility issues. These two groups were chosen after examining over a dozen groups because of their high level of activity and that both groups had multiple posts on a daily basis. Prior approval for the research project was attained by contacting the online group administrators. Due to the composition of the websites, our participants consisted of all women. Participants' ages ranged from 21 to 43 (mean = 29) years. The majority of participants were Caucasian (97.5%), while approximately 2% reported that their ethnicity was African-American. Reported activity levels on the virtual community indicated that participants had regularly read messages (M = 5.0), posted messages (M = 3.84) and started new threads (M = 3.09) during the two weeks prior to participating in the study.

Participants were provided with a link on their message boards to complete an online survey anonymously. By clicking on the link participants were taken to another page, which contained the consent form for the study. As soon as the participants clicked on the “I agree to participate” link, they were conducted to the online survey page. At the bottom of the online survey page, participants were given the opportunity to win a \$25 gift certificate to Amazon.com by entering their e-mail address before submitting their answers.

4.2 Measures

Participants completed attitudinal and behavioral survey items that measured the degree to which they provided, received, and observed the exchange of emotional and informational support within the community, their sense of virtual community, their level of stress, and their physical health symptoms.

4.2.1 Demographic Information

Participants reported their gender, age, and ethnicity. Additionally, they indicated how frequently they had read messages, posted messages, and started new threads in the virtual community over the past 2 weeks. Ratings were made on a 6-point scale ranging from “never” to “all the time”.

4.2.2 Emotional Support

Items were developed to measure the frequency with which participants provided, received, and observed the exchange of emotional support within the virtual community. Items were adapted from validated measures of emotional support [11]. Participants responded to items on a 6-point scale ranging from “never” to “all the time”. Three items were used to assess how often participants *provided* emotional support to other members of the online community by posting messages: How often have you provided emotional support to other group members in your posts? How often have you discussed your feelings with other group members in your posts? How often have you provided

sympathy and understanding to other group members in your posts? Two items assessed how often participants *received* emotional support from other members' posts was measured: How often have you received emotional support from other group members' posts? How often have you received sympathy and understanding from other group members in their posts? Three items were developed to measure how often participants *observed* the exchange of emotional support among group members: How often have you seen others exchange emotional support in their posts? How often have you seen others discuss their feelings in their posts? How often have you seen group members exchange sympathy and understanding to each other in their posts?

4.2.3 Informational Support

The researchers also developed items to assess how often participants provided, received, and observed the exchange of informational support within the virtual community. Participants responded to items on a 6-point scale ranging from "never" to "all the time". The content of the items was adapted from validated measures of instrumental support developed by Carver and colleagues [11]. Three items assessed how often participants *provided* informational support to other members of virtual community: How often have you provided information to other group members in your posts? How often have you provided advice to other group members in your posts? How often have you shared your own experiences with others who have similar infertility/pregnancy problems in your posts? Three items assessed how often participants *received* information from other members' posts: How often have you received information from other group members in their posts? How often have you received advice from other group members in their posts? How often have others who have similar infertility/pregnancy problems shared their experiences with you through a post? Three items measured how often participants *observed* the exchange of information among group members: How often have you seen others exchange information in their posts? How often have you seen others exchange advice in their posts? How often have you seen others share their own experiences with others who have similar infertility/pregnancy problems in their posts?

4.2.4 SOVC

Eighteen items were used to assess sense of virtual community [4]. Sample items include "I think this is a good group for me to be a member," "I anticipate how some members will react to certain questions or issues in this group," and "I feel obligated to help members of this group." Responses ranged from 1=Strongly Disagree to 7=Strongly Agree. Reliabilities range from .91 to .93.

4.2.5 Perceived Stress

Perceived stress was measured with Cohen, Kamarck, and Mermelstein's [14] Perceived Stress Scale (PSS). Reliability for this measure is good with Cronbach alphas ranging from .84 to .86. The PSS has also shown good predictive validity, with perceived stress scores predicting depressive symptoms, physical health symptoms, and social anxiety [14]. The inventory consists of 14 items (e.g., How often have you felt nervous and stressed? How often have you felt that you were unable to control the important things in your life?), in which participants were asked to indicate the frequency with which they experienced stressful

thoughts and feelings in the last 2 weeks. Responses were made on a 6-point scale ranging from "never" to "all the time".

4.2.5 Health Symptoms

The Pennebaker Inventory of Limbic Languidness [the Pill, 40] was used to assess participants' physical health symptoms. The Pill is a 54-item scale that measures the occurrence of common physical symptoms and sensations (e.g., headache; back pain; dizziness; insomnia; upset stomach). Past research indicates strong reliability (Cronbach's alphas: .88-.91) for the Pill. In the current research, participants were asked to indicate whether they had experienced each symptom in the last two weeks (responding yes or no). A score was computed for each participant by summing the total number of symptoms they had indicated.

5. RESULTS

Means, standard deviations, and scale reliabilities for all variables are reported in Table 1. Cronbach alphas ranged from .85 to .96 indicating good reliability for all measures used here. Intercorrelations between supportive communication variables (providing, receiving, and observing the exchange of emotional and informational support) and the outcome variables are reported. Correlation analyses were also conducted to examine whether our demographic variables (age, ethnicity) were related to any of our primary outcome variables (SOVC, stress, support, symptoms). Because neither age nor ethnicity was associated with the other variables in this study, we did not control for these demographics in the following analyses.

5.1 Supportive Communication as Predictors of SOVC

A linear regression analysis was conducted to examine supportive communication variables as predictors of SOVC. The measures of providing emotional support, providing informational support, receiving emotional support, receiving informational support, observing the exchange of emotional support, and observing the exchange of informational support were entered into a regression equation predicting SOVC (see Table 2). These variables accounted for 35% of the variance in SOVC. Consistent with Hypothesis 1, observing the exchange of both emotional support and informational support were significant predictors of SOVC. However, providing and receiving either type of support was not related to SOVC (p 's > .20). Interestingly, while observing the exchange of emotional support was positively associated with SOVC ($\beta = .46$, $p = .005$), observing the exchange of informational support was negatively associated with SOVC ($\beta = -.34$, $p = .035$).

5.2 SOVC and Stress as Predictors of Health Symptoms

Moderated regression analyses [1] were conducted to examine SOVC, perceived stress, and the interaction between SOVC and stress as predictors of physical health symptoms experienced by participants (see Table 3). Scores on SOVC and perceived stress were transformed into standardized z-scores [1]. A SOVC x Stress interaction term was then computed by multiplying these two terms. SOVC and perceived stress scores were entered into the regression in step 1. In the second step, the SOVC x Stress

interaction was entered. Together, these variables accounted for approximately 12% of the variance in health symptoms.

Consistent with past research and as proposed in Hypothesis 2, perceived stress predicted health symptoms ($\beta = .32, p = .001$), such that higher levels of perceived stress were associated with more health symptoms. In addition, as predicted in Hypothesis 3, SOVC was negatively associated with health symptoms ($\beta = -.18, p = .04$), such that participants who experienced greater SOVC in the virtual health community had fewer health symptoms. Finally, providing support for Hypothesis 4, the SOVC x Stress interaction approached significance as a predictor of health symptoms ($\beta = -$

.17, $p = .06$). To better understand the nature of these interactions, means were estimated at high (+1 SD) and low (-1 SD) levels of each of the terms of the interaction (see Figure 1). The pattern of results indicates that a strong SOVC was not associated with a decrease in health symptoms for participants who experienced low levels of stress. However, among participants who experienced high levels of perceived stress, participants with a strong SOVC had fewer health symptoms than participants with a weak SOVC. As predicted, SOVC appears to have served as a buffer (against physical health symptoms) for participants who experienced high levels of stress.

Table 1: Descriptive Statistics

	M	SD	1	2	3	4	5	6	7	8	9
1. Providing Emotional Support	4.07	1.46	(.96)								
2. Providing Informational Support	3.88	1.39	.85**	(.93)							
3. Receiving Emotional Support	4.41	1.38	.68**	.60**	(.94)						
4. Receiving Informational Support	4.49	1.28	.58**	.59**	.82**	(.92)					
5. Observing Emotional Support	5.58	.64	.39**	.37**	.50**	.54**	(.92)				
6. Observing Informational Support	5.48	.70	.35**	.40**	.48**	.54**	.87**	(.88)			
7. SOVC	5.59	.99	.46**	.44**	.49**	.50**	.42**	.31**	(.92)		
8. Perceived Stress	3.16	.63	.16	.02	-.01	-.11	.03	-.03	.05	(.85)	
9. Health Symptoms	14.03	8.93	.06	-.07	-.03	-.11	.02	.02	-.13	.27**	(.91)

Note. ** indicates $p < .01$.

Table 2: Supportive Communication Variables as Predictors of SOVC

Model	B	S.E.	β
<i>SOVC</i>			
Providing Emotional Support	.04	.11	.05
Providing Informational Support	.14	.11	.20
Receiving Emotional Support	.09	.11	.12
Receiving Informational Support	.14	.11	.18
Observing Emotional Support	.71	.25	.46* *
Observing Informational Support	-.49	.23	-.34*

Note. $R^2 = .35, * p < .05, ** p < .01$.

Table 3: Results of the hierarchical multiple regression analysis of health symptoms

Model	B	S.E.	β
<i>Step 1</i>			
SOVC	-1.31	.78	-.15
Stress	2.50	.78	.28**
<i>Step 2</i>			
SOVC	-1.61	.79	-.18*
Stress	2.81	.79	.32**
SOVC X Stress	-1.71	.90	-.17 ^t

Note. Step 1: $R = .10, p < .10, R \Delta$ for Step 2 = .02, $p = .06$; ^t $p = .06$
* $p < .05, ** p < .01$.

6. DISCUSSION

This study examined the relationships between supportive communication, SOVC, and health outcomes for women participating in a virtual health community for infertility. Two primary research questions were examined. First, we examined the degree to which posting, receiving, and observing the exchange of emotional and informational support contributed to SOVC within the virtual community. Second, we tested whether SOVC was associated with positive health outcomes. We hypothesized that SOVC would be associated with fewer reported health symptoms among virtual community members, particularly among those experiencing high levels of perceived stress. Our findings show initial support for these predictions.

Supportive communication has been shown to be an important component of virtual health communities. In particular, past studies have documented the frequent exchange of emotional support (e.g., empathy and encouragement) and informational support (e.g., advice, references) among members of these groups. In the current study, we examined a previously unstudied potential benefit of exchanging support, specifically whether emotional and informational supportive communication would contribute to the development of a SOVC within the community. Our results indicate that observing the exchange of emotional and informational support in the virtual community was associated with SOVC. Interestingly, while the exchange of emotional support was related to a stronger SOVC, observing the exchange of information was associated with a weaker SOVC.

Although the negative relationship between information and SOVC was unexpected, it is not inconsistent with the way that SOVC has been conceptualized in previous work. Indeed, in their work on sense of community (in FtF settings) McMillan and Chavis (1986) describe a shared emotional connection between members as “the definitive element for true community” (p.14). Because the SOVC construct is based on the FtF sense of community construct [6, 33, 43], it should not surprise us to see the importance of emotional communication for a SOVC. The current findings further underscore these emotional underpinnings of SOVC, and interestingly, suggest that the exchange of information may in fact decrease SOVC. While exchanging information undoubtedly provides other benefits to members of virtual communities (e.g., keeping members well-informed about treatments), it appears to detract from the development of a sense of community among members. One possible explanation could be that unlike, say, cancer treatment, in which new alternative and traditional medical developments occur rapidly, infertility has few new treatment options beyond timed intercourse, alternative or traditional medications to induce ovulation (e.g., acupuncture or Clomid), or in-vitro fertilization (IVF). Thus, repeated exchanges of the same information may suggest the presence of new members who do not know some of the basic fertility options and who have also not established themselves in the group¹. Additionally, women in infertility groups experience feelings of success and failure *monthly*. Regular emotional support may be particularly important for women who do not graduate from their online infertility group.

While past research has primarily focused on examining the benefits of directly giving and receiving support in virtual health communities (though posting and receiving posts), the current study also examined whether positive outcomes were associated with simply observing support exchanged by others in the community. We predicted that all three types of supportive behavior (giving, receiving, observing) would be associated with SOVC. However, we found that SOVC was only related to observing the exchange of support. More frequent posting of emotional and informational support was not linked to stronger SOVC, nor was directly receiving supportive posts from other community members. Instead, SOVC in our study appears to derive primarily from the observation of others exchanging support, rather than directly giving and receiving support oneself. Although other research has found that directly exchanging support is related to SOVC, observing support still has the stronger relationship [4]. Additionally, observing support may be a key component of SOVC in order for members to perceive that they are with similar others who are also receiving support [36].

In addition to investigating the relationship between supportive communication and SOVC, we also examined whether SOVC was linked to positive health outcomes, and whether it moderated the relationship between stress and health. Our results showed that SOVC was negatively related to health symptoms, indicating that women who had a stronger SOVC experienced fewer health symptoms. Consistent with a large

¹ One may note that the primary goal of an infertility support group is to leave or “graduate” from it.

body of research linking stress with poor health outcomes, we also found that women in the virtual community who experienced higher levels of stress had more physical health symptoms. However, having a strong SOVC buffered this relationship between stress and health symptoms. In other words, women who experienced a strong SOVC in this group did not experience the detrimental effects of stress on their health.

To our knowledge, this is one of the first studies that has examined whether certain characteristics of virtual community participation can buffer the relationship of stress on physical health outcomes. Importantly, these findings illustrate the ability of virtual health communities to provide some of the same stress-buffering benefits that FtF supportive networks have been shown to provide. Further, the findings suggest that development of SOVC is a critical element for deriving health benefits from virtual community participation.

6.1 Implications

The results of this study have practical implications for both women who are seeking support in infertility groups as well as for the administrators of these groups. First, because our study demonstrates that participating in these groups can ameliorate the negative effects of stress which comes from infertility, women should be encouraged to seek these groups out. Because merely observing the exchange of support is helpful, it may permit women an escape from a health problem which can be very isolating.

Second, administrators should facilitate communication and the members’ ability to see the exchange of support. There may be technical ways to achieve this, such as allowing members to easily see the number of replies or how frequently messages are read. Although observing support is important in SOVC, the actual exchange of support is necessary for the group to survive. Therefore, administrators (or group leaders) may want to promote communication in which women are able to provide emotional support and others can see it. Additionally, we would encourage administrators to particularly focus on the emotional support for the members, given the benefits associated with emotional rather than informational support in the current study.

This research also implies that SOVC may be an important component of the positive health outcomes in online health groups. For researchers, we propose that SOVC may be a useful construct for others to consider. Further research may benefit from examining other positive outcomes associated with SOVC, as well as other antecedents of SOVC in virtual health communities. These findings can also provide administrators with practical information on ways to enhance a SOVC within virtual health communities.

6.2 Limitations

Although the present study provides interesting insights into the role of SOVC in virtual health communities, there are some limitations to this work. One limitation of the current design is its inability to firmly establish the causal direction between the variables. Although the implied direction between the variables (supportive communication leading to SOVC; SOVC leading to reduced health symptoms) is consistent with past research and theory in these areas, it is possible that the direction is reversed

(i.e., SOVC leads to more observing of the exchange of emotional support) or reciprocal between variables. However, we think this may be a bigger criticism if we found that SOVC was related to posting of support instead of observing it. In addition, the interaction between SOVC and stress in reducing the physical health symptoms is less easily explained away as an artifact of correlational research [48].

Our results also rely on self-report data, which can be associated with social desirability, as well as other response biases. However, although self-report data was used, we attempted, where possible, to have participants report on actual behaviors that were used by themselves and others (i.e., providing support, receiving support).

In the current research, we focused on self-report measures because we believe that it is ultimately the members' perceptions or construals of the support they receive and observe in online health communities that will lead to a SOVC. However, we suggest that future researchers may also want to examine more objective measures of these constructs by measuring and coding indicators of supportive communication and SOVC in the messages posted by members of virtual health communities.

Additionally, the current sample is somewhat limited in its diversity. While two different virtual infertility communities were examined here (including one that is nationally based), there was little racial diversity within the sample of women who responded to our survey (although this is somewhat true of the internet in general). Further, due to the nature of the virtual health community that was examined (infertility), our sample consisted of only women.

6.3 Future Directions

We perceive that we are just at the beginning of understanding the benefits of online health groups, particularly how members' SOVC can improve their coping and outcomes. We suggest that longitudinal designs are a very important next step in this research program. It will be very important to track members as they enter the group, learn about it and its members and become participants in it (or not) and to determine their changes in SOVC and health outcomes.

In addition, we have suggested in this study that infertility groups have unique characteristics: members have monthly successes and failures and many can successfully "graduate" from the group. It will be important to see if our findings about the importance of emotional support over informational support and observing versus exchanging support will generalize to other online health groups. For example, people with irritable bowel syndrome may have daily anxiety whereas people with cancer may have less frequent, but still intensive diagnosis and treatment schedules. We suggest that SOVC will continue to play an important role and that the general processes of exchanging support will remain the same for other virtual health communities; however, the exact mechanism by which the SOVC is maintained may be somewhat context dependent.

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