A social identity perspective on participation in virtual healthcare communities

Completed Research Paper

Na LIU
Department of Information Systems
National University of Singapore
13 Computing Drive, Singapore, 117417
liuna@comp.nus.edu.sg

Hock Chuan CHAN
Department of Information Systems
National University of Singapore
13 Computing Drive, Singapore, 117417
chanhc@comp.nus.edu.sg

Abstract

Virtual healthcare communities are incorporating social network features to motivate more participation. Using the lens of social identity theory, this study looks at how the social network structure of virtual healthcare communities influences participation via social identity. In specific, the effect of cognitive, emotional and evaluative components of social identity are investigated. Uncertainty in illness theory is also applied to understand the concerns of individuals in virtual healthcare communities. Both archival and survey data are collected to test the research model. Our results show the influence of social identity on participation, as well as the connections among the three components of social identity. The importance to understand uncertainty in illness in virtual healthcare communities is also shown. Social network features are also shown to play important roles in encouraging participation. The findings provide implications for both research and practice in this area.

Keywords: virtual healthcare community, participation, social identity, social network, uncertainty in illness

Introduction

Virtual healthcare communities are online communities facilitating peer-to-peer communication, self-diagnosis and providing diverse health information (Misra et al. 2008). They are now playing an important role in self-disease management by enabling healthcare information systems to shift from institution-centric to patient-centric (Demiris 2006). Virtual healthcare communities have lower participation barriers than traditional communities (Laing et al. 2004), as participating in virtual communities requires less time and lower commitment. A large amount of research is devoted to demonstrate the effectiveness of virtual healthcare communities. Virtual healthcare communities have been shown to have a direct impact on people's health by reducing depression, enhancing social support, and encouraging preventive actions (Eysenbach et al. 2004). They empower patients by informing them better and enhance their social well-being ultimately (van Uden-Kraan et al. 2009). However, the effectiveness of virtual healthcare communities cannot be fully realized without the participation of members.

Social identity in a virtual community is shown to have a positive influence on participation desires (Dholakia et al. 2004). While many studies treat social identity as a unitary construct, it actually consists of three interdependent components: cognitive, emotional and evaluative social identity (Ellemers et al. 1999). For virtual healthcare communities, whether the three components influence individual's participation in the same way or differently is unknown yet. In this study, we are motivated to look at how different components of social identity influence member participation.

R1. How do the cognitive, emotional and evaluative components of social identity influence member participation in a virtual healthcare community?

Online healthcare communities now are not simply providing a platform for people with health concerns to post inquiries and look for supports. More and more are incorporating social network features to connect their members further. Members can articulate a list of other members and share connections with them. They can also share their profile with connected members and traverse along the chain of connection to know other people in the community. Displaying connections publicly is believed to be an important identity signal helping people navigate their networked social connections (Donath and Boyd 2004). However, how social network structure influences social identity formation with the virtual community is unknown. Thus, our second research question is presented as follows:

RQ2: How will the social network structure of a virtual healthcare community influence social identity with the community?

Most communities have their members bonded by common interests and practices (Ridings and Gefen 2004). Virtual healthcare communities are different in the way that their members and visitors are driven by the needs for social support as they are bothered by uncertainty in illness. People with uncertainty in illness have limited cognitive capacity and high stress level at the same time (Mishel 1988). Thus, their feelings about the virtual community and participatory behaviors may be different from those communities for sharing of interests. The uniqueness of virtual healthcare community membership calls for studies on its influence on individual's identification with the community and subsequent behaviors in the community. Motivated thus, this study will look at how individuals' uncertainty in illness influences their social identity with a virtual healthcare community.

RQ3: How does uncertainty in illness influence social identity in a virtual healthcare community?

The main objective of this study is to progress toward a comprehensive understanding of member participation in virtual health communities. Drawing on the theory of social identity, uncertainty in illness theory and literature on social network structure, this study advances the theoretical development of social identity theory in general and particularly in the area of virtual healthcare communities. This research also provides important practical implications for virtual healthcare community management by assessing actual participation using archival data.

Theoretical Background

In this study, we base our examination of participation in virtual healthcare communities on the social identity theory, social network literature, and uncertainty in illness theory. Specifically, the literature on social network structure is used to understand the virtual relationships formed in a virtual healthcare community. Uncertainty in illness theory best describes the concern of members in virtual communities for healthcare. Social identity theory explicates the cognitive, emotional and evaluative components of social identity which may influence participation in a virtual healthcare community.

Social network structure in a virtual healthcare community

The web of social relationships that surround individuals is called a social network (Heaney and Israel 2002, p.185). In offline communities, social relationships are important to participants' health (Loader et al. 2002). Virtual relationships formed in an online community are also helpful for patients to cope with their situations (Schweizer et al. 2006). The social network structure of a community or a group can be described by homogeneity, geographic dispersion, and density (House et al. 1988; Israel 1982). For a virtual community, geographic dispersion is not an issue; the current study will only investigate density and homogeneity.

Density is often used as an indicator for community dynamics. In this study, it refers to the extent to which virtual healthcare community members know and interact with each other on average (Heaney and Israel 2002). The density of a network can be calculated as the number of ties in the network divided by the number of pairs of people (Knoke and Kuklinski 1982). However, researchers argue that density is more likely to be a perceived experience (Rapoport 1975) rather than a simple number derived from a mathematical formula. Network-level density measure can be a problematic index of structural cohesion for a network with subgroups (Friedkin 1981), as different parts of a network may have different levels of density (Epstein 1969). In addition, comparison of density measures across networks that differ in size is also misleading (Friedkin 1981). Thus, members' perception of density is considered for the current study. Perceived density of a network is able to predict an individual's behaviors or subjective perceptions (Rapoport 1975). It reflects an individual's own evaluation of the network with whom he/she "interacts most intensely and most regularly", which is the "effective network" of the individual (Epstein 1969, pp.101-111).

Homogeneity is defined as the extent to which network members are similar with each other (Heaney and Israel 2002). Demographic information is usually used as the criteria for homogeneity evaluation (Turner et al. 1987). In a virtual healthcare community, where members are facing various health problems, health concerns and medical experience become a proper factor determining virtual healthcare community homogeneity. Thus, in our study, homogeneity refers to the extent to which members are similar in terms of symptoms and illnesses. The perception of ingroup homogeneity is also shown to be a significant predictor of ingroup behaviors and perceptions (Simon 1992). It is particularly important to understand the role of network homogeneity in communities where communications occur virtually (Ibarra 1995). For example, as interpersonal similarity increases the predictability of others' behavior and thus reduces communication apprehension, homogeneity is shown to influence communication and performance in the context of computer-mediated collaborative learning (Yuan and Gay 2006). In this study, we will look at the influence of homogeneity in virtual healthcare communities.

A three-component operationalization of social identity

Social identity theory defines groups in terms of people's self-conception as group members (Hogg 2006). It also emphasizes the importance of social group memberships to individuals' self-concept and thus identity (Hogg 2006). According to the theory, social identity is defined as "that part of the individuals' self-concept which derives from their knowledge of their membership of a social group (or groups) together with the value and emotional significance of that membership" (Tajfel 1981, p.255). According to this definition, when individuals perceive themselves to be members of a social category, they will be emotionally involved in this common definition of themselves, and reach a certain degree of social consensus on how to evaluate their group and the associated membership (Tajfel and Turner 1986).

Therefore, social identity is not a unitary construct and it involves three components including cognitive, emotional and evaluative ones (Cameron 2004; Ellemers et al. 1999; Jackson and Smith 1999).

The *cognitive* component of social identity represents self categorization of a member to a social group. In this self categorization process, an individual attributes self to a group, depersonalizes self-conception and develops his own identity as a group member (Hogg and Abramms 1988; Tajfel and Turner 1986). The cognitive awareness of group membership in a social group can be enhanced as a result of the self-categorization process (Ellemers et al. 1999). The cognitive component of social identity is often operationalized as the frequency with which membership in a given group comes to mind (Gurin and Markus 1989) and the subjective importance of the group to self-definition (Luhtanen and Crocker 1992). In a virtual community context, cognitive social identity is evident in categorization processes, whereby individuals form a self awareness of their virtual community membership, derived from an understanding of similarities with other members and dissimilarities with non-members (Ashforth and Mael 1989; Turner 1985). In this study, the cognitive social identity in a virtual healthcare community is assessed by *ingroup identification*, which is defined as the cognitive awareness of community membership (Ellemers et al. 1999).

The emotional perspective of social identity is found to be the most important factor determining social identity (Bagozzi and Lee 2002). The *emotional* component stands for a sense of belonging with the group, i.e., the affective commitment to the group and involvement in the group (Cameron 2004; Ellemers et al. 1999; Jackson and Smith 1999). People cognitively attached to a group may have different in-group behaviors depending on the extent of their affective commitment to the group (e.g., Doosje et al. 1995; Ellemers and Van Rijswijk 1997). Belonging to a virtual community also has its emotional significance. In a virtual community, emotional social identity implies a sense of affective commitment, emotional closeness and common bonds to the virtual community or community members (Cameron 2004). *Affective commitment* is used as the conceptualization of the emotional social identity in this study. It is defined as the feeling of being emotionally involved with the virtual healthcare community (Ellemers et al. 1999).

The *evaluative* component of social identity represents an evaluation of negative and positive values involving the membership (Cameron 2004; Ellemers et al. 1999). The evaluative social identity can be influenced by the comparison of a group's status against similar groups or the evaluation of self-gains from the membership (Cameron 2004; Ellemers et al. 1999). For example, in an organizational context, the evaluative component of social identity refers to "the degree to which organizational members believe that they can satisfy their needs by participating in roles within the context of an organization" (Pierce et al. 1989, p.625). In this study, an evaluative social identity is measured by *group esteem*, which is defined as the evaluation of values attached to a virtual healthcare community membership (Ellemers et al. 1999).

Uncertainty in illness theory

Uncertainty is originally defined as "the period of anticipation prior to confrontation with a potentially harmful event" (Monat et al. 1972, p.237). Facing illness, patients and their families step into a world of many unknowns including strange hospital personnel, settings, equipment, procedures, overwhelming medical terms, and other problems. Inevitably, uncertainty becomes a major component of their illness experience. According to uncertainty in illness theory, *uncertainty in illness* consists of four forms, including "ambiguity concerning the state of the illness, complexity regarding the treatment and the system of care, lack of information about the diagnosis and seriousness of the illness and unpredictability as to the course of the disease and prognosis" (Mishel and Braden 1988, p98). The definition of uncertainty in illness is originally developed to understand the concern of hospitalized patients (Mishel 1981). In this study, we adapt the original definition and use uncertainty in illness to describe the concern of people who join virtual healthcare communities. It is defined as an individual's general perceived inability to solve health-related problems, including diagnosis, medication, coping strategies and others.

Uncertainty can be both objective and perceptual (Milliken 1987). Objective uncertainty usually refers to explicit cues in the environment (Milliken 1987). Perceived uncertainty is an individual's judgment about a situation or event based on cues (Mishel 1981). Perception of reality is likely to differ from objective reality due to limitations in human's cognitive reasoning abilities (MacCrimmon 1966). For example, whether a situation can be judged as uncertain or certain depends on whether it can be adequately

structured or categorized and whether there are sufficient cues to make the judgment (Budner 1962). Thus, perceptual uncertainty always varies with individual attributes (Downey et al. 1975; McCaskey 1976) and contextual factors (Pfeffer 1983). As the interest of this study is to investigate individuals' health concern, perceptual measurement of uncertainty in illness will be used.

Participation in virtual healthcare communities

Community participation has been defined as "a social process in which specific groups with shared needs living in a defined geographical area actively pursue identification of their needs and establish mechanisms to meet them" (Bichmannm et al. 1989, p.168). Many studies have been conducted to look at participation in virtual communities (e.g., Oh and Jeon 2007; Wasko and Faraj 2005; Xu and Jones 2010), as participation is the key to community sustainability. In general, participation in virtual communities can be divided into active and passive participation (Koh et al. 2007). Active participation activities mainly refer to posting activity; examples of passive participation activities are members' viewing activities. However, virtual community participation is usually conceptualized in multiple ways given the different focus of virtual communities. For example, in an open source software community, participation includes fixing bugs or making modification of the software (Xu and Jones 2010). In a healthcare community, participation consists of asking questions, answering questions, sharing experience and etc. Researchers also point out that users' ways of participation are affected by IT infrastructure (Koh et al. 2007; Ren et al. 2007). In a typical virtual healthcare community with social network features, such as PatientsLikeMe.com, the communication platform consists of forum, blog (or self-created entries for disease monitoring and medication recording), and the function of connecting users. Thus, in this study, we will look at user participation in virtual healthcare communities from three perspectives including writing a blog entry, posting in a forum and having connections with other users.

Research Model and Hypotheses

The research model is presented in Figure 1. The dependent variable in our model is members' actual participation in a virtual healthcare community. The model depicts the hypothesized influence of social network characteristics and members' uncertainty in illness on social identity formation, as well as the influence of social identity on participation.
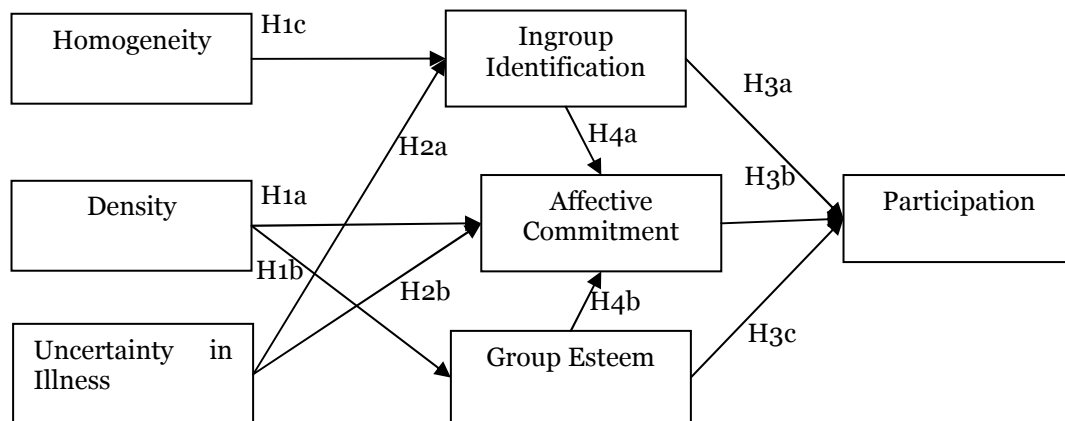

Figure 1. Research Model

The influence of social network structure on social identity

A social identity results from a person's knowledge that he or she belongs to a group (Hogg and Abramms 1988). Thus, individual's perception of group-level factors will influence the formation of social identity with the group. Perception of network density implies a sense of connectedness, which leads to affective

attraction of a group and a sense of belonging to the group (Rettie 2003). As a function of the degree of emotional involvement with the virtual community (Bergami and Bagozzi 2000), affective commitment will be strengthened by a dense network. Similarly, if a healthcare community member perceives that the community has a dense network structure in general, he is more likely to have a favorable attitude towards the community. Thus, as a dense network of relationships provides a sense of identity and belonging to the community (Podolny and Baron 1997), we predict that it will lead to higher affective commitment to the virtual healthcare community.

H1a. Perceived density of a virtual healthcare community is positively related to affective commitment.

Social identity theory suggests that the identification with social groups should be firstly derived from their functionality (Hogg and Abramms 1988), which refers to the groups' ability to fulfill the important needs of members (Dholakia et al. 2004). In particular, referring to the value connotation of that particular group membership (Ellemers et al. 1999), group esteem is usually affected by the status of the group (Ellemers et al. 1999) and the perceived value of the group (Luhtanen and Crocker 1992). The functionality and values of a virtual healthcare community lie in its ability for members to share feelings and seek information. Network density is shown to provide high levels of instrumental and information support in an offline community (Heaney and Israel 2002). It is also likely that higher levels of emotional and appraisal support are available in dense social network systems if individuals within the network know and interact with each other (Ashida 2005). Virtual community researchers also suggest that to maintain a reasonable level of community dynamics, it is important to have a high density of computer-mediated communications in the virtual community (Jones 1997). Thus, if individuals feel the virtual healthcare community has a dense network structure, they may attribute a better value to the community in terms of providing social supports. Hence, we hypothesize that:

H1b. Perceived density of a virtual healthcare community is positively related to group esteem.

Social psychology literature has demonstrated that that similarity of attitude, value and belief leads to ingroup attraction and interaction (Huston and Levinger 1978). In particular, social identity theory suggests that people perceiving greater intragroup similarities will have more familiarity and identification with the group (Linville et al. 1989). Thus, in the offline context, people tend to categorize themselves and others in terms of gender, race, age and other demographic information (Turner et al. 1987). These characteristics provide the basis for people to further differentiate between similar and dissimilar others (Turner et al. 1987). In the organizational context, demographic homogeneity is also shown to strengthen organizational ingroup prototypes (Hogg and Terry 2000). In the context of a virtual healthcare community, members' perceptions of ingroup similarities in terms of symptoms, types of disease and other health concerns will also lead to a higher identification with the community and a stronger self-categorization with the community. Therefore, we predict that perceived homogeneity of a virtual healthcare community is positively related to ingroup identification.

H1c. Perceived homogeneity of a virtual healthcare community is positively related to ingroup identification.

The influence of uncertainty in illness on social identity

As uncertainty in illness is usually perceived as a significant stressor to patients' well-being (Neville 2003); it can affect individual's psychosocial adaptation to disease dramatically (McCormick 2002). One possible coping strategy affected by feeling of uncertainty is by joining a group with people having similar concerns. Hogg's (2000) motivational theory of social identity processes posits that social identification and group behaviors can be motivated by uncertainty reduction. The theory argues that when individuals feel uncertain about issues that are particularly important to themselves, their uncertainty can be reduced through the process of identifying with a group.

Researchers argue that uncertainty can be reduced when "similar others agree with us, or when we can agree with similar others" (Hogg and Mullin 1999, p.255). The self-categorization process reduces uncertainty by providing a social context to compare with similar others and help individuals to validate their cognitions and behaviors (Hogg 2002). In an online healthcare community, it is very likely that people want to know whether the information they gathered on a certain disease is agreed by others experiencing similar problems. Uncertainty in illness drives members to identify with their virtual

community cognitively. Thus, we predict that shared uncertainties about illness will enhance individuals' cognitive awareness of their group membership in a virtual healthcare community.

H2a. Uncertainty in illness is related to member's ingroup identification with a virtual healthcare community.

Uncertainty about self-perceptions, feelings and attitudes can be reduced by ingroup prototype (Hogg 2003), which is formed through the self-categorization process. For example, if members of a virtual healthcare community are dealing with their diseases optimistically, an individual's uncertainty in illness can be diluted by a more optimistic ingroup prototype. The purpose of a virtual healthcare community is to help patients reduce stress, and gain more information on the disease and thus enhance self-confidence (Demiris 2006). According to social identity theory, the uncertainties would drive them to identify themselves with the community and similar others who share common stressful situations and or developmental transitions. This will lead to their emotional involvement to the virtual healthcare community. Researchers also state that uncertainty is related to social attraction among group members (Mullin and Hogg 1999). Thus, we predict that uncertainty in illness drive members to identify with their virtual community emotionally.

H2b. Uncertainty in illness is related to member's affective commitment with a virtual healthcare community.

The influence of social identity on member participation

Social identity in a virtual community is shown to have a positive influence on participation desires (Dholakia et al. 2004). Higher identification is argued to render a member to maintain a more positive relationship with other members in the virtual community (Hogg and Abrams 1988). One important way to maintain the positive relationship is through active participation in online social interaction (Dholakia et al. 2004). Empirical studies also reveal that the emotional and affective aspects of social identity influence acts of in-group favoritism (Ellemers et al. 1999). In organizational context, social identity is found to instigate performance of organizational citizenship behaviors by firm employees (Bergami and Bagozzi 2000). Ethnographic research on a healthcare community dedicated to depression concerns reveal that members differing in number of social ties and involvement to the community also vary in consumption of health information, regularity of community activity and number of postings (Misra et al. 2008). Thus, we argue that social identity prescribes and promotes active participation in virtual healthcare community.

H3: Social identity is positively related to member participation.

H3a. Ingroup identification is positively related to member participation.

H3b. Affective commitment is positively related to member participation.

H3c. Group esteem is positively related to member participation.

The Mediating role of affective commitment

We also posit that ingroup identification and group esteem will further influence affective commitment. Ingroup identification provides the cognitive basis for members' identification with the community (Ellemers et al. 1999). In other words, salient community membership influences an individual's evaluations of and feelings for other people in the community (Hogg et al. 2004). Thus, social attraction and affective attachment to a community is a function of how much one identifies with the community (Hogg 1992, 1993). An empirical study on organizational behavior reveals that the cognitive component of social identity influences citizenship behavior through the effect of affective commitment (Bergami and Bagozzi 2000). Affective commitment is believed to provide a more direct motivational force, while ingroup identification lays the cognitive basis of the motivational force (Bergami and Bagozzi 2000). In a virtual healthcare community, when members categorize themselves as part of the community, they are more likely to have positive feelings of the community. Thus, we hypothesize that:

H4a. Ingroup identification will lead to higher affective commitment.

Evaluative social identity may covary with emotional social identity (Tajfel and Turner 1979). Empirical studies show that affective commitment tends to be stronger in more positively evaluated groups (Ellemers et al. 1999). Better valuation of the group status will associate more favorable attitude toward group membership. At the same time, people are likely to distance themselves from less attractive groups. The main purpose for people to join a virtual healthcare community is to look for informational and emotional support from individuals who share similar experiences (Mo et al. 2009). If a community is highly valued by its members or well recognized among similar types of communities, it is more likely to receive higher emotional attachment from its members. Thus, we predict that:

H4b. Group esteem will lead to higher affective commitment.

Research Method

To assess the proposed research model, a field study was conducted with two forms of data collection: questionnaire and archival data. For survey instrument development, existing validated scales were adopted wherever possible. All questions in the survey were adjusted to reflect the specific context of virtual healthcare communities. Ingroup identification, group esteem, affective commitment, perceived density, perceived homogeneity and uncertainty in illness were all operationalized as reflective constructs. To assess the three social identity components, scales from Ellemers et al. (1999) were used. The measurement for perceived density and perceived homogeneity were modified based on Heaney and Israel's (2002) definition of social network characteristics. To measure uncertainty in illness, we adapted scales from Mishel (1981) which was originally developed for hospitalized patients. We have rephrased some questions to make them relevant to virtual healthcare communities' users who may have different levels of health concerns.

The validity of the items was assessed in two ways. First, the items were examined by two experts who were familiar with the topic for face validity. Second, a sorting procedure was performed with four judges to assess the conceptual validity of the instrument (Moore and Benbasat 1991). All items were measured using a seven-point Likert-type scale with anchors from "Strongly disagree" to "Strongly agree". The survey items are presented in Appendix A.

Participation was assessed by archival data and was operationalized as a formative construct following the procedures proposed by Petter et al. (2007). It was constructed to cover major perspectives of virtual healthcare community activities, including the number of posts in the community, the number of friends in the community and the number of blog articles created at the platform provided by the community. For members with no blog established, they have zero for the number of blog articles.

The health portal selected for the survey has more than 4000 registered users and more than 400 active members who have posted in the forum. It is a health portal with frequently updated health information and also provides forums for different types of disease. There are blog functions provided by the health portal. Members can maintain a personal blog if they like. The health portal also consists of social network features by allowing members to add others as friends. Friends' update of profile, mood, blog entries and other activities within the community are displayed on each member's homepage when they log in to the community.

The survey invitation was displayed as a banner advertisement on the homepage of the health portal. Members were told that completion of the survey will be rewarded with a mobile phone top-up card. 82 complete responses were received. Archival data for these respondents were retrieved two months later. Several control variables were included in the survey, including sex, age, education and marital status.

Data Analyses and Results

We examined the descriptive statistics, the measurement model, and the posited structural model using partial least squares (PLS).

Descriptive Statistics

Table 1 details the descriptive statistics. The respondents' demographic information is summarized in Table 2.

Table 1. Descriptive Statistics					
	Short form	Minimum	Maximum	Mean	Std. Deviation
Ingroup Identification	Ingroup	2.00	7.00	4.95	1.34
Group Esteem	Esteem	1.00	7.00	5.10	1.30
Affective Commitment	Affect	2.00	7.00	5.48	1.13
Density	Density	1.00	7.00	4.36	1.42
Homogeneity	Homogeneity	1.33	6.00	3.97	1.27
Uncertainty in Illness	Uncertainty	1.00	6.08	3.70	1.42
Participation	Participation				
blogarticles		0	2926	117	411
postinforum		0	852	23	109
friends		0	163	17	37

Table 2. Demorgraphic Information of Respondents (N = 82)		
Gender	Male	29 (35.4%)
	Female	53 (64.6%)
Age (years old)	< 20	2 (2.4%)
	20-25	18 (21.9%)
	25-30	32 (39.0%)
	30-35	15 (18.3%)
	35-40	4 (4.9%)
	>40	11 (13.4%)
Marrital Status	Married	45 (54.8%)
	Single	37 (45.1%)
Education	Senior School	10 (12.2%)
	College	59 (72.0%)
	Post Graduate	13 (15.8%)

Measurement Model

To validate the measurement model, the reliability and validity of the constructs were assessed. As shown in Table 3, the composite reliabilities of constructs exceeded Nunnally's (1978) criterion of 0.7, and

Cronbach's alphas were also higher than 0.7. Thus, all constructs demonstrated acceptable levels of reliability. To check for discriminant validity, the correlations between constructs should be less than the square root of average variance extracted for a construct. Table 3 reports the results of discriminant validity, which is checked by comparing the diagonal to the non-diagonal elements. All items fulfilled the requirement of discriminant validity.

Construct	1	2	3	4	5	6	Composite Reliability	Cronbach's Alpha
Ingroup	0.88						0.92	0.86
Affect	0.63	0.88					0.94	0.97
Esteem	0.52	0.56	0.90				0.95	0.92
Density	0.52	0.54	0.43	0.91			0.94	0.90
Homogeneity	0.31	0.25	0.10	0.36	0.89		0.92	0.87
Uncertainty	0.25	0.14	0.17	0.22	0.40	0.82	0.97	0.96

Table 3. Reliability and Correlation Matrix

Factor analysis was also performed to check convergent validity. As there is no requirement for the measures of formative construct to be highly correlated, common factor analysis is not applicable for formative constructs (Rossiter 2002). Thus, the dependent variable (participation) is not entered for principal component analysis. The results of factor analysis (see Table 4) also indicate that the all items are loaded on their intended constructs.

Table 4. Results of Factor Analysis

	Component					
	1	2	3	4	5	6
Ingroup1	.15	.34	.03	.21	.08	.73
Ingroup2	.07	.27	.37	.18	.22	.72
Ingroup3	.16	.18	.38	.25	.07	.71
Esteem1	.00	.14	.77	-.01	-.09	.17
Esteem2	.05	.14	.90	.13	.12	.16
Esteem3	.12	.26	.86	.22	-.01	.11
Esteem4	.06	.32	.84	.25	-.04	.10
Affect1	-.04	.71	.29	.03	.01	.48
Affect2	-.05	.81	.26	.05	-.05	.35
Affect3	-.03	.78	.27	.13	.07	.41
Affect4	.13	.81	.25	.36	.06	.05
Affect5	.14	.76	.15	.48	.15	-.08
Desnsity1	.11	.23	.16	.76	.33	.11
Desnsity2	.06	.21	.24	.84	.06	.24
Desnsity3	.11	.19	.13	.88	.05	.20
Homogeneity1	.30	.34	.03	.18	.72	.07
Homogeneity2	.19	-.06	-.03	.16	.88	.14

Homogeneity3	.22	-.02	-.02	.04	.87	.06
Uncertainty1	.70	.02	.25	.20	-.18	.04
Uncertainty2	.79	.19	.08	-.11	.01	.02
Uncertainty3	.70	.15	.24	.01	.02	.14
Uncertainty4	.72	.05	-.10	.20	-.05	.16
Uncertainty5	.86	-.08	-.00	.08	.01	.14
Uncertainty6	.76	.07	.04	.03	.20	.08
Uncertainty7	.83	-.12	.113	-.05	.04	.12
Uncertainty8	.91	.03	-.13	.02	.07	.05
Uncertainty9	.87	-.03	-.03	.09	.13	.06
Uncertainty10	.80	.03	.03	.15	.36	-.09
Uncertainty11	.86	.04	-.02	.09	.26	-.09
Uncertainty12	.88	.10	-.01	.07	.20	-.07
Uncertainty13	.88	.01	-.01	.00	.27	-.08
Uncertainty14	.87	-.07	.14	.00	.09	.05

The validity of the formative construct (Participation)

To assess the validity of Participation, multicollinearity among its indicators was assessed, as high collinearity among indicators implies redundant information in the formative construct (Bollen and Lennox 1991; Diamantopoulos and Winklhofer 2001). The variance inflation factors (VIF) for each indicator is used to assess the possible presence of collinearity (Bruhn et al. 2008). VIF<3.3 is usually used a rule of thumb to assess multicollinearity among indicators for formative construct (Diamantopoulos and Siguaw 2006). The VIFs for blog articles, post in forum and the number of friends are 1.86, 1.34 and 2.32 respectively. Thus, there is no multicollinearity among indicators of the construct participation. We further assess robustness of the operationalization of participation by evaluating the effect of indicator numbers on formative indicator weight significance (Cenfetelli and Bassellier 2009). One indicator of participation, blogarticle, is not significantly different from zero (Table 5). The results imply that relative effect of blogarticle on participation is not significant. According to the guideline, if there is indictor with VIF greater than 3.3., the item with insignificant item loading can be removed from the construct while preserving content validity (Petter et al. 2007). In our study, as all indicators of participation have VIF less than 3.3., all indicators were kept for the assessment of structural model.

Table 5. Statistics on the Formative Construct Participation				
	Path (Weight)	t-stat	p value	VIF
blogarticles	-0.23	1.13	0.26	1.86
postinforum	1.25	2.54	0.01	2.32
friends	0.81	3.93	<0.001	1.34

Structural Model

The path coefficients and the explained variances for the model using a bootstrapping procedure are shown in Figure 2. Hypotheses were tested at the 5 percent significance level.
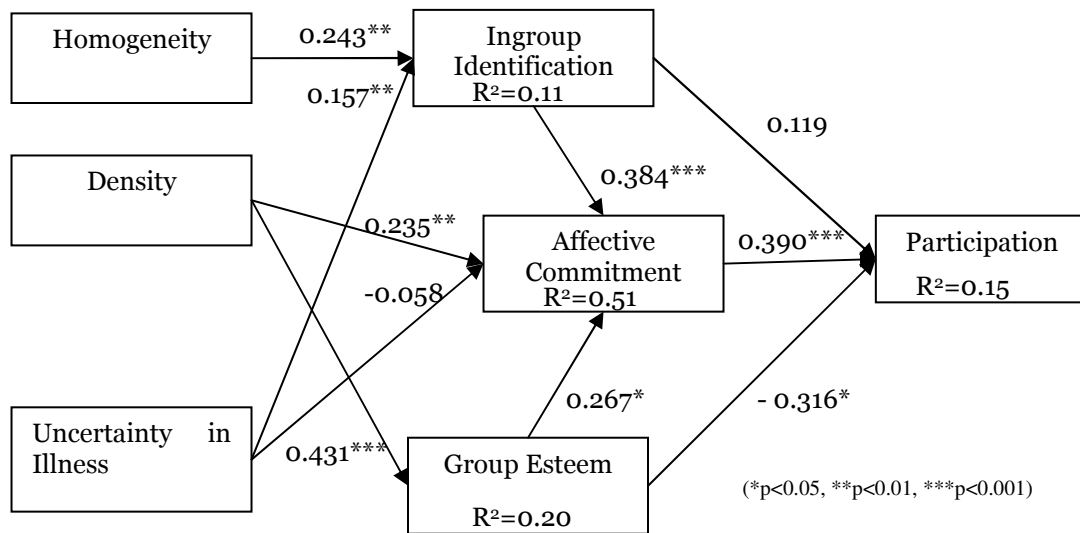
Figure 2. Results of Hypotheses Testing

The results show that homogeneity has a significant influence on ingroup identification (t=4.07, p<0.001). Uncertainty in illness also influences ingroup identification significantly as predicted (t=2.57, p=0.012). Homogeneity and uncertainty in illness are able to explain 11% of the variation in ingroup identification.

Group esteem is predicted by density of the community (t=5.34, p<0.001). R^2 for group esteem is 0.19. Affective commitment is influenced by density (t=3.26, p=0.002), but not affected by uncertainty in illness (t=1.15, p=0.253). Ingroup identification also influences affective commitment significantly (t=5.13, p<0.001), and so does group esteem (t=3.37, p=0.001). R^2 for affective commitment is 0.51.

Affective commitment predicts participation significantly (t=3.80, p<0.001), while ingroup identification shows no effect on participation (t=1.02, p=0.30). Group esteem is shown to have a significant negative impact on participation (t=2.56, p=0.012). 15% of the variance in participation is explained by the three components of social identity.

The results of hypotheses testing are summarized in Table 6. We also tested for the effect of gender, age, marital status and education, with no significant effects.

Table 6. Results of Hypotheses Testing				
Hypothesis (path)	Path Coefficient	*t*-Value	P-value	Supported?
H1a. Density → Affect (+)	0.235	3.26	0.002	Yes
H1b. Density → Esteem(+)	0.431	5.34	<0.001	Yes
H1c. Homogeneity→ Ingroup(+)	0.243	4.07	<0.001	Yes
H2a. Uncertainty → Ingroup(+)	0.157	2.56	0.012	Yes
H2b. Uncertainty → Affect (+)	-0.058	1.15	0.253	No
H3a. Ingroup → Participation (+)	0.119	1.02	0.309	No
H3a. Affect → Participation (+)	0.390	3.80	<0.001	Yes
H3a. Esteem → Participation (+)	-0.316	2.56	0.012	No
H4a. Ingroup → Affect (+)	0.384	5.13	<0.001	Yes
H4b. Esteem → Affect (+)	0.267	3.37	0.001	Yes

Discussion and Implications

In general, the empirical results are encouraging and provide support for most of the hypotheses. The results confirm that social identity with a virtual healthcare community determines members' participation, and it can be influenced by virtual community social network structure and members' uncertainty about health.

Homogeneity of social network in a virtual healthcare community affects members' cognitive acknowledgement of membership. Individuals' evaluated density of a healthcare community network influences both affective commitment and group esteem. Thus, our results imply that social network characteristics strengthen member's identification with a virtual healthcare community. It is consistent with the literature on offline social network, which states that higher density and higher homogeneity are helpful in maintaining social identity (House et al. 1988).

Uncertainty in illness determines ingroup identification, but not affective commitment. Researchers have argued that the influence of uncertainty on social identity may be moderated by group entitativity (Hogg et al. 2007). In specific, people with higher level of uncertainty identify most strongly with their group when the group was more clearly structured and more distinctive (Hogg et al. 2007). However, virtual healthcare communities are different from task-oriented groups as they may lack clear structure or clear prototype. This may be one possible reason why uncertainty in illness does not influence members' affective commitment to a virtual healthcare community.

In terms of the predicted effect of social identity on participation, affective commitment is revealed to play a mediating role in this study. Affective commitment is shown to influence members' participation in a virtual healthcare community. However, ingroup identification does not affect participation directly as predicted; its effect on participation is mediated by affective commitment. One possible reason is that ingroup identification only lays the foundation of social identity cognitively (Cameron 2004); it does not stimulate actual behavior. Thus, ingroup identification indirectly influences participation in a positive way.

We also found that the evaluative component of social identity, group esteem, influences members' participation. However, it does not predict participation positively as hypothesized. The data analysis shows that individuals having higher group esteem are less likely to participate in the virtual community. One possible reason is due to the nature of virtual healthcare communities. The main reason for people to join a virtual healthcare community is to look for informational and emotional support (Leimeister et al. 2005). If a community is highly valued by its members, the community must be quite effective in addressing members' concerns and needs. As a result, members do not need to actively participate in order to get support. Instead, "lurking" activities, such as browsing and searching are sufficient to empower members (van Uden-Kraan et al. 2009).

At the same time, the effect of group esteem on participation is mediated by affective commitment in a positive way. The results imply that greater group esteem leads to higher affective commitment, which in turn encourages participation. This is consistent with the literature that the evaluative social identity may covary with emotional social identity (Tajfel and Turner 1979), as affective commitment tends to be weaker in more negatively evaluated groups. Thus, an interesting finding from the data analysis result is that group esteem has both negative and positive effect on participation.

To summarize, the results show that social identity in general influences participation in virtual healthcare communities. Among the components of social identity, the role of emotional social identity is the most salient.

Theoretical contributions

This study advances the theoretical development of social identity theory in general and particularly in the area of virtual healthcare community. Building on previous operationalization of social identity into three interdependent sub-constructs (Ellemers et al. 1999), this study further explores the connections among them. We found that ingroup identification and group esteem influence affective commitment in the context of a virtual healthcare community.

This study provides a better understanding on participation in a virtual healthcare community. Social identity is shown to increase participation desires (Dholakia et al. 2004). Our study further explores the effect of different components of social identity. Ingroup identification does not influence participation directly; its effect on participation is mediated by affective commitment. Group esteem shows two different ways of influencing participation. The direct effect reduces the need for active participation while the indirect effect encourages participation by enhancing the affective commitment to the community.

The study also bridges the gap between healthcare theory and social identity theory. Social identity theory states that uncertainty in general serves as a motivation for stronger identification with a group (Hogg 2000). Degree of uncertainty in illness may determine patients' coping strategies including avoidance, information-seeking and etc. (Mishel 1981). Patients will seek ways to reduce uncertainty or to learn methods to cope with uncertainty, through means like social resources or health providers (Neville 2003). The study demonstrates that the cognitive component of social identity is highly likely to be affected by uncertainty in illness.

This study has demonstrated the importance of the perceived network structure of a virtual community. Social network structure is usually described as a single value for a community. Our study reveals that individuals' perceptions of network structure vary a lot, which confirms the importance of perceived experience with social network (Rapoport 1975). We also provide validated instruments to assess perceived homogeneity and perceived density of a virtual healthcare community.

The study contributes to the understanding of member behaviors in virtual healthcare communities using objective measures. Most studies use self-reported measurement to assess participation behavior in virtual community, such as "How many times did you chat online with you group" (Dholakia et al. 2004). Although self-reported measures reflect individuals' feeling more directly, objective measures provides an unbiased measure of the fact.

Practical contributions

This research also provides important practical implications for virtual healthcare community management. Researchers and practitioners believe that participation leads to the effectiveness of a virtual healthcare community (Eysenbach et al. 2004) and members become more empowered through participation (Demiris 2006). However, they also believe that the effectiveness depends on the setting and delivery of virtual communities (Eysenbach et al. 2004). One major argument among community managers is whether to have several targeted platforms or only a few general platforms. In a targeted platform, only one or a few illnesses are discussed, while in a more general platform, people with a variety of health concerns can join.

This study looks at how individuals' social identity with the community will affect their participation in the community, and what are the factors contributing to social identity, including illness-related concern and community characteristics. This study shows that homogeneity plays a less significant role in predicting participation via social identity, compared with density. It implies that members are not concerned too much about how similar they are with other members in the community. Instead, they feel more comfortable to participate in a less targeted forum but with feelings of closeness. Thus, we would recommend community managers to consider broadening the discussion topics of a single forum. Rather than focusing on a single disease type, forums should allow discussion on other relevant diseases types as well.

Limitation and Future Research

The findings of the study need to be interpreted in light of its limitations. First, participation is only measured by forum posts, blog posts and number of friends due to the available functions provided by the surveyed community. The instruments could be modified when assessing participation in other communities. Second, while our research improves the understanding of how social identity can be influenced by social network features of virtual community, it does not provide information on how functional features of virtual community interplay with social network structure within the community, such as the features of blog functions. Future research may investigate the role of technological

affordances of a virtual healthcare community. Also, our study has looked at members with uncertainty in illness in general. However, people with acute and chronic disease may have different needs for community support (Endler et al. 2001). Future studies can look at people's informational and emotional needs in virtual healthcare community with different disease types.

Conclusion

The use of virtual healthcare communities to enhance peoples' well-being is currently hampered by a lack of understanding of how participation can be stimulated in such environments. Thus motivated, this study aims to explain how different components of social identity affect individual's participation in virtual healthcare communities. The study uses the lenses of social identity theory, uncertainty in illness theory and social network literature to model the social network and illness-related perceptions that influence participation via social identity. Overall the study contributes by explicating how the cognitive, emotional and evaluative components of social identity affect people's participation in a virtual healthcare community. It also highlights the role of social network structure and uncertainty in illness. By providing a better understanding of this emerging healthcare platform, i.e., virtual healthcare communities, this study can help healthcare providers and community managers in encouraging participation and empowering community members.

References

Ashforth, B., and Mael, F. 1989. "Social Identity Theory and the Organization," *The Academy of Management Review* (14:1), pp 20-39.

Ashida, S. 2005. "Social Network Characteristics and Intention to Participate in Social Activity Programs at a New Senior Center." The Ohio State University, p. 225.

Bagozzi, R., P., and Lee, K.H. 2002. "Multiple Routes for Social Influence: The Role of Compliance, Internalization, and Social Identity," *Social Psychology Quarterly* (65:3), pp 226-247.

Bergami, M., and Bagozzi, R.P. 2000. "Self-Categorization, Affective Commitment and Group Self-Esteem as Distinct Aspects of Social Identity in the Organization " *British Journal of Social Psychology* (39:4), pp 555-577.

Bichmannm, W., Rifkin, S., and Shrestha, M. 1989. "Toward the Measurement of Community Participation," *World Health Forum* (10), pp 467-472.

Bollen, K., and Lennox, R. 1991. "Conventional Wisdom on Measurement: A Structural Euqation Perspective," *Psychological Bulletin* (110:2), pp 305-314.

Bruhn, M., Georgi, D., and Hadwich, K. 2008. "Customer Equity Management as Formative Second-Order Construct," *Journal of Business Research* (61:12), pp 1292-1301.

Budner, S. 1962. "Intolerance of Ambiguity as a Personality Variable," *Journal of Personality* (30), pp 29-50.

Cameron, J.E. 2004. "A Three-Factor Model of Social Identity," *Self and Identity* (3), pp 239-262.

Cenfetelli, R.T., and Bassellier, G. 2009. "Interpretation of Formative Measurement in Information Systems Research," *Management Information Systems Quarterly* (33:4), pp 698-708.

Demiris, G. 2006. "The Diffusion of Virutal Communities in Healthcare: Concept and Challenges," *Patient Education and Counseling* (62), pp 178-188.

Dholakia, U.M., Bagozzi, R., P., and Pearo, L.K. 2004. "A Social Influence Model of Consumer Participation in Network- and Small-Group-Based Virtual Communities," *International Journal of Research in Marketing* (21:3), pp 241-263.

Diamantopoulos, A., and Siguaw, J.A. 2006. "Formative Versus Reflective Indicators in Organizational Measure Development: A Comparison and Empirical Illustration," *British Journal of Management* (17:4), pp 263-282.

Diamantopoulos, A., and Winklhofer, H.M. 2001. "Index Construction with Formative Indicators: An Alternative to Scale Development," *Journal of marketing Research* (38:2), pp 269-277.

Donath, J., and Boyd, D. 2004. "Public Displays of Connection," *BT Technology Journal* (22), pp 71-82.

Doosje, B., Ellemers, N., and Spears, R. 1995. "Perceived Intragroup Variability as a Function of Group Status and Identification," *Journal of Experimental Social Psychology* (31:5), pp 410-436.

Downey, H.K., Hellriegel, D., and Slocum, J.W. 1975. "Environmental Uncertainty: The Construct and Its Applications," *Administrative Science Quarterly* (20), pp 613-629.

Ellemers, N., Kortekaas, P., and Ouwerkerk, J.W. 1999. "Self-Categorisation, Commitment to the Group and Group Self-Esteem as Related but Distinct Aspects of Social Identity," *European Journal of Social Psychology* (29), pp 371-389.

Ellemers, N., and Van Rijswijk, W. 1997. "Identity Needs Versus Social Opportunities: The Use of Group-Level and Individual-Level Identity Management Strategies," *Social Psychology Quarterly* (60:1), pp 52-65.

Endler, N.S., Kocovski, N.L., and Macrodimitris, S.D. 2001. "Coping, Efficacy, and Perceived Control in Acute Vs Chronic Illnesses," *Personality and Individual Differences* (30:4), pp 617-625.

Epstein, A. 1969. "The Network and Urban Social Organization," in: *Social Networks in Urban Situations,* J.C. Mitchell (ed.). Manchester: Manchester University Press.

Eysenbach, G., POwell, J., Englesakis, M., Rizo, C., and Stern, A. 2004. "Health Related Virtual Communities and Electronic Support Groups: Systematic Review of the Effects of Online Peer to Peer Interactions," *BMJ* (328:1166).

Friedkin, N.E. 1981. "The Development of Structure in Random Netowkrs: An Analysis of the Effects of Increasing Network Density on Five Measures of Structure," *Social Networks* (3), pp 41-52.

Gurin, P., and Markus, H. 1989. "Cognitive Consequences of Gender Identity," in: *The Social Identity of Women,* S. Skevington and D. Baker (eds.). London: Sage, pp. 152-172.

Heaney, C.A., and Israel, B.A. 2002. "Social Networks and Social Support," in: *Health Behavior and Health Education: Theory, Research, and Practice,* K. Glanz, F. Lewis and B. Rimer (eds.). San Francisco, CA: Jossey-Bass, pp. 179-205.

Hogg, M.A. 2000. "Subjective Uncertainty Reduction through Self-Categorization: A Motivational Theory of Social Identity Processes and Group Phenomena.," in: *European Review of Social Psychology,* W. Stroebe and M. Hewstone (eds.). Chichester, UK: Wiley.

Hogg, M.A. 2002. "Subjective Uncertainty Reduction through Self-Categorization: A Motivational Theory of Social Identity Processes," *European Review of Social Psychology* (11:1), pp 223-255.

Hogg, M.A. 2003. "Social Identity," in: *Handbaook of Self and Identity,* M.R.Leary and J.P.Tangney (eds.). New York: Guilford, pp. 462-479.

Hogg, M.A. 2006. "Social Identity Theory," in: *Contemporary Social Psychological Theories,* P.J. Burke (ed.). Stanford, California: Stanford Soical Sciences, pp. 111-136.

Hogg, M.A., and Abramms, D. 1988. *Social Identifications: A Social Psychology of Intergroup Relations and Group Processes.* London: Routledge.

Hogg, M.A., Abrams, D., Otten, S., and Hinkle, S. 2004. "The Social Identity Perspective: Intergroup Relations, Self-Conception, and Small Groups," *Small Group Research* (35:3), pp 246-276.

Hogg, M.A., and Mullin, B.-A. 1999. *Joining Groups to Reduce Uncertainty: Subjective Uncertainty Reduction and Group Identification. .* Oxford: Blackwell.

Hogg, M.A., Sherman, D.K., Dierselhuis, J., Maitner, A.T., and Moffitt, G. 2007. "Uncertainty, Entitativity, and Group Identification," *Journal of Experimental Social Psychology* (43:1), pp 135-142.

Hogg, M.A., and Terry, D.J. 2000. "Social Identity and Self-Categorization Processes in Organizational Contexts," *The Academy of Management Review* (25:1), pp 121-140.

House, J.S., Landis, K.R., and Umberson, D. 1988. "Social Relationships and Health," *Science* (241:4865`), pp 540-545.

Huston, T.L., and Levinger, G. 1978. "Interpersonal Attraction and Relationship," *Annual Review of Psychology* (29), pp 115-156.

Ibarra, H. 1995. "Homophily and Differential Returns: Sex Differences in Network Structure and Access in an Advertising Firm," *Administrative Science Quarterly* (37:3), pp 422-447.

Israel, B.A. 1982. "Social Networks and Health Status: Linking Theory, Research, and Practice.," *Patient counselling and health education* (4:2), pp 65-79.

Jackson, J.W., and Smith, E.R. 1999. "Conceptualizing Social Identity: A New Framework and Evidence for the Impact of Different Dimensions," *Personality and Social Psychology Bulletin* (250:1), pp 120-135.

Jones, Q. 1997. "Virtual-Communities, Virtual Settlements & Cyber-Archaeology: A Theoretical Outline," *Journal of Computer-mediated Communication* (3:3).

Knoke, D., and Kuklinski, J.H. 1982. *Network Analysis.* Beverly Hills, Calif: Sage.

Koh, B.J., Kim, Y.-G., Butler, B., and Bock, G.-W. 2007. "Encouraging Participation in Virtual Communities," *Commmuications of the ACM* (50:2), pp 69-73.

Laing, A., Hogg, G., and Winkelman, D. 2004. "Healthcare and the Information Revolution: Re-Configuring the Healthcare Service Encounter," *Health Services Management Research* (17:3), p 1880199.

Leimeister, J.M., Ebner, W., and Krcmar, H. 2005. "Design, Implementation and Evaluation of Trust-Supporting Components in Virtual Communities for Patients," *Journal of Management Information Systems* (21:4), pp 101-135.

Linville, P., Fischer, G.W., and Salovey, P. 1989. "Perceived Distributions of the Characteristics of Ingroup and Outgroup Members: Empirical Evidence and a Computer Simulation," *Journal of Personality and Social Psychology* (57), pp 165-188.

Loader, B.D., Muncer, S., Burrows, R., Pleace, N., and Nettleton, S. 2002. "Medicine on Line? Computer-Mediated Social Support and Advice for People with Diabetes," *International Journal of Social Welfare* (11:1), pp 53-65.

Luhtanen, R., and Crocker, J. 1992. "A Collective Self-Esteem Scale: Self-Evaluation of One's Social Identity," *Personality and Social Psychology Bulletin* (18), pp 302-318.

MacCrimmon, K.R. 1966. "Descriptive and Normative Implications to the Decision Theory Postulates," in: *Risk and Uncertainty: Proceedings of a Conference Held by the International Economic Association,* K. Borch and J. Mossin (eds.). New York: St. Martin's Press, pp. 1-21.

McCaskey, M.B. 1976. "Tolerance for Ambiguity and the Perception of Environment Uncertainty in Organizational Design," in: *The Management of Organizational Design,* R. Kilmann, L. Ponday and D. Slevin (eds.). New York: St. Martin's Press, pp. 1-21.

McCormick, K. 2002. "A Concept Analysis of Uncertainty in Illness," *Journal of Nursing Scholarship* (34), pp 127-131.

Milliken, F.J. 1987. "Three Types of Perceived Uncertainty About the Environment: State, Effect and Response Uncertainty.," *Academy of Management Review* (12:1), pp 133-143.

Mishel, M. 1981. "The Measurement of Uncertainty in Illness," *Nursing Research* (30:5), pp 258-263.

Mishel, M.H. 1988. "Uncertainty in Illness," *Journal of Nursing Scholarship* (20:4), pp 225-232.

Mishel, M.H., and Braden, C. 1988. "Finding Meaning: Antecedents of Uncertainty in Illness," *Nursing Research* (37:2), pp 98-127.

Misra, R., Mukherjee, A., and Peterson, R. 2008. "Value Creation in Virtual Communities: The Case of a Healthcare Web Site," *International Journal of Pharmaceutical and Healthcare Marketing* (2:4), pp 321-377.

Mo, P.K.H., Malik, S.H., and Coulson, N.S. 2009. "Gender Differences in Computer-Mediated Communication: A Systematic Literature Review of Online Health-Related Support Groups," *Patient Education and Counseling* (75:1), pp 16-24.

Monat, A., Averill, J.R., and Lazarus, R.S. 1972. "Anticipatory Stress and Coping Reactions under Various Conditions of Uncertainty," *Journal of Personality and Social Psychology* (24:2), pp 237-253.

Moore, G.C., and Benbasat, I. 1991. "Development of an Instrument to Meaasure the Perceptions of Adopting an Information Technology Innovation," *Information Systems Research* (2:3), pp 192-222.

Mullin, B.-A., and Hogg, M.A. 1999. "Motivations for Group Membership: The Role of Subjective Importance and Uncertainty Reduction," *Basic & Applied Social Psychology* (21:2), pp 91-102.

Neville, K.L. 2003. "Uncertainty in Illness: An Integrative Review," *Orthopaedic Nursing* (22:3), pp 206-214.

Oh, W., and Jeon, S. 2007. "Membership Herding and Network Stability in the Open Source Community: The Ising Perspective," *MANAGEMENT SCIENCE* (53:7), July 1, 2007, pp 1086-1101.

Petter, S., Straub, D.W., and Arun, R. 2007. "Specifying Formative Constructs in Information Systems Research," *MIS Quarterly* (31:4), pp 623-656.

Pfeffer, J. 1983. "Organizational Demography," in: *Reserach in Orgnizational Behavior,* L.L. Cummings and B.M. Staw (eds.). Greenwich, CT: JAI Press, pp. 299-357.

Pierce, J.L., Carner, D.G., Cummings, L.L., and CDunham, R.B. 1989. "Organization-Based Self-Esteem: Construct Definition, Measurement, and Validation.," *Academy of Management Journal* (32), pp 622-648.

Podolny, J.M., and Baron, J.N. 1997. "Resources and Relationships: Social Networks and Mobility in the Workplace," *American Sociological Review* (62:5), pp 673-693.

Rapoport, A. 1975. "Toward a Redefinition of Density," *Environment and Behavior* (7:2), pp 133-158.

Ren, Y., Kraut, R., and Kiesler, S. 2007. "Applying Common Identity and Bond Theory to Design of Online Communities," *Organization Studies* (28:3), March 1, 2007, pp 377-408.

Rettie, R. 2003. "Connectedness, Awareness and Social Presence," in: *6th international presence workshop*. Aalborg.

Ridings, C.M., and Gefen, D. 2004. "Virtual Community Attraction: Why People Hang out Online," *Journal of Computer-mediated Communication* (10:1).

Rossiter, J.R. 2002. "The C-Oar-Se Procedure for Scale Development in Marketing," *International Journal of Research in Marketing* (19), pp 305-335.

Schweizer, K.J., Leimeister, J.M., and Krcmar, H. 2006. "The Role of Virtual Communities for Social Network of Cancer Patients," in: *12th Americas conference on information systems*. Acapulco, Mexico.

Simon, B. 1992. "The Perception of Ingroup and Outgroup Homogeneity: Reintroducing the Intergroup Context," *European Review of Social Psychology* (3), pp 1 - 30.

Tajfel, H. 1981. *Human Groups and Social Categories: Studies in Social Psychology*. Cambridge, England: Cambridge University Press.

Tajfel, H., and Turner, J.C. 1979. "An Integrative Theory of Intergroup Conflict," in: *The Social Psychology of Intergroup Relations,* W.G. Austin and S. Worchel (eds.). Monterey, California: Brooks/Cole, pp. 33-47.

Tajfel, H., and Turner, J.C. 1986. "The Social Identity Theory of Intergroup Behavior," in: *The Social Psychology of Intergroup Relations* S. Worchel and W. Austin (eds.). Chicago: Nelson-Hall, pp. 7-24.

Turner, J.C. 1985. "Social Categorization and the Self-Concept: A Social Cognitive Theory of Group Behaviour.," in: *Advances in Group Processes: Theory and Reserach,* E.J. Lawler (ed.). Greenwich, CT: JAI.

Turner, J.C., Hogg, M.A., Oakes, P., Reicher, S., and Wetherell, M. 1987. *Rediscovering the Social Group: A Self-Categorization Theory*. Oxford: Basil Blackwell.

van Uden-Kraan, C.F., Drossaert, C.H.C., Taal, E., Seydel, E.R., and van de Laar, M.A.F.J. 2009. "Participation in Online Patient Support Groups Endorses Patients' Empowerment," *Patient Education and Counseling* (74), pp 61-69.

Wasko, M.M., and Faraj, S. 2005. "Why Should I Share? Examining Social Capital and Knowledge Contribution in Electronic Networks of Practice," *MIS Quarterly* (29:1, Special Issue on Information Technologies and Knowledge Management), pp 35-57.

Xu, B., and Jones, D.R. 2010. "Volunteers' Participation in Open Source Software Development: A Study from the Social Relational Perspective," *The DATA BASE for Advances in Information Systems* (41:3), pp 69-84.

Yuan, Y.C., and Gay, G. 2006. "Homophily of Network Ties and Bonding and Bridging Social Capital in Computer-Mediated Distributed Teams " *Journal of Computer-Mediated Communication* (11:4).

Appendix A.

Appendix A. Construct Operationalization	
Measures	**References**
Density	Modified from (Heaney and Israel 2002)
1. In this community, members know each other quite well.	
2. In this community, members interact with each other a lot.	
3. In this community, members have a lot of interaction with each other.	
Homogeneity	Modified from (Heaney and Israel 2002)
1. In this community, members have the same illness.	
2. In this community, members have the same symptoms.	
3. In this community, members are suffering from the same disease.	
Uncertainty in illness	Modified from (Mishel 1981)
1. I have a lot of questions on my health conditions without answers.	
2. I have received so much information about my health condition that I cannot tell what is most important.	
3. I have been given many differing opinions about what is wrong with me.	
4. I have not got a specific diagnosis.	
5. I do not know when to expect things (e.g. medical treatment, surgery) will be done to me.	
6. My treatment is too complex to figure out.	
7. It is difficult to know if the treatments or medications I am getting are helping me.	
8. I don't know how my illness will be treated.	
9. I am not sure about the complexity of the treatment of my illness.	
10. The course of my illness keeps changing; I have my good and bad days.	
11. My symptoms continue to change unpredictably.	
12. I don't know how my symptoms will change.	
13. I am unsure if my illness is getting better or worse.	
14. I am not sure about how much care I need from others because of the illness.	
Ingroup Identification	(Cameron 2004; Ellemers et al. 1999)
1. I identify with other members of this community.	
2. This community is an important reflection of who I am.	
3. When I talk about the community I am participating, I usually say "we" rather than "they".	
Affective Commitment	(Cameron 2004; Ellemers et al. 1999)
1. In general, I'm glad to be a member of this community.	
2. I feel good about being a member of this community.	
3. I feel like part of the family at this community.	
4. I feel emotionally attached to this community.	
5. I feel a strong sense of belonging to this community.	

Group esteem	(Cameron 2004; Ellemers et al. 1999)
1. Overall, my community is considered good by others.	
2. Most people consider my community, on the average, to be more effective than other community.	
3. In general, others respect the community that I am a member of.	
4. In general, others think that the community I am a member of is unworthy.	