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Abstract:

People are increasingly looking for health-related information and support to empower their self-management and decision making. Online health communities have not only become an important alternative source of patient-centered information but also appear to serve an emotional support role in connecting patients who have similar medical conditions. Trust is critical to sustain their continuous use and enhance their involvement. This is because each community member is typically identified only by a pseudonym, important personal information is often revealed, the quality of information provided by others varies, and the consequences of acting on incorrect advice can be severe. Using semi-structured interviews and data from postings, this study qualitatively explores the trust development between users of forum-based online health communities. Based on data from a wide range of medical conditions, we formulated a three-process framework for establishing trust that conceptualizes how users build trust through the text-based medium and how they progress from one process to another. We contribute to theory by extending existing variance theories in trust to a hybrid process theory which explains the dynamic progression from one state to another. It suggests several design foci that can enhance user experience of these forums.

Keywords: trust, online community, patient-centered, e-health, credibility

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I. INTRODUCTION

None of us have medical experience, not at all. With people who are interested in controlling our own pain and understanding us, we don't just take everybody, doctors or whoever's words without thinking…. We don't lie down and be[come] guinea pigs to people. We find out as much as we can because it's our body. You only get one chance with it. [If] someone gives you wrong drugs and you have a massive reaction, you could die. So you have to know and understand everything which goes into your mouth or heart.
(Interviewee A14, a chronic pain patient)

In the traditional paternalistic patient–clinician relationship, patients rely on physicians to solve their medical problems and derive physical, mental, and psychological comfort from their interactions with physicians [Morgan, 2003]. However, interactions under this traditional approach have been long criticized for being primarily doctor-centered or disease-centered rather than patient-centered [Howie, Hopton, Heaney, and Porter, 1992; Morgan, 2003]. That is, physicians have traditionally assumed a type of project-manager role at the expense of patient-centered activities, such as responding to emotions and enabling patient self-management [McCormack et al., 2011].

However, many patients want to take an active role in managing their illness [Mauksch, Dugdale, Dodson, and Epstein, 2008; Nelson, 2008], especially those who want to be prepared patients and avoid coercion [Hu, Bell, Kravits, and Orrange, 2012; Laugharne, Priebe, McCabe, Garland, et al., 2011], and actively search for what might best be described as "just-in-time someone-like-me" information [Fox and Jones, 2009]. Online health communities meet these needs by providing an alternative source of information about medical conditions, particularly the lived experience of people with that condition, but also provide emotional support via other patients. To an individual member, the interactions with other community members can be more valuable than consultations with treating physicians, partly because the community empathizes with that person's needs, but also because it can offer advice based on first-hand experience about how to deal with day-to-day problems at the time the advice is needed (i.e., no need to wait for the next consultation) [Langer, 2009; McMullan, 2005]. In effect, the community interactions are types of medical consultations and so are a highly patient-centered form of healthcare.

A significant downside of these community interactions, however, is that community members tend to be patients with no systematic medical training. The quality of user-generated health advice is, therefore, highly variable [Fox and Rainie, 2000]. In worst-case scenarios, medical professionals fear that use of this material could lead to a worsening of the existing condition, delays in treatment, violation of privacy through posting sensitive and personally identifiable information online, or inducement of feelings of distress or trauma [Benigeri and Pluye, 2003].

With online health communities being high-value but also high-risk information sources, one would expect that how they are used would feature prominently in studies of how people evaluate online health information. However, this is not presently the case. Instead, studies to date have tended to focus on information provided by organizations such as television and radio stations, hospitals, government health departments, and research institutes, and have ignored user-generated content environments [Dutta-Bergman, 2004; Eysenbach, Powell, Kuss, and Sa, 2002; Metzger, Flanagin, and Medders, 2010; Wang, Walther, Pringree, and Hawkins, 2008]. The existing evaluation criteria emphasizing source credibility, accuracy, currency, completeness, and so on [Eysenbach et al., 2002; HON, 2012; NLM, 2012; Wang and Lui, 2007] may be inadequate for assessing user-generated content, because the user-generated content is discursive, subjective, experiential, and "quality signals become more faint and diffused and cognitive overload occurs frequently" [Agarwal, Gupta, and Kraut, 2008, p. 244].

The evaluation factors suggest a plausible relationship between trust in information and its author. Because research institutes and governments are perceived as more authoritative, objective, and hence trustworthy, information they provide has been found to be perceived as more accurate, current, complete, objective, and credible than information provided by pharmaceutical companies [Hall, Jones, and Iverson, 2011]. Thus, credible information is seen to be more likely to come from a trustworthy source [Hovland and Weiss, 1951].

As a risk-reduction mechanism, trust has been found to facilitate information and knowledge sharing [Zhang, 2007] and transactional intentions [Bansal, Zahedi, and Gefen, 2010; Kim, 2008; Lu, Zhao, and Wang, 2010]. These studies largely focused on forming trust by analyzing the characteristics of a trustee [Mayer, Davis, and Schoorman, 1995]. However, in a relationship-oriented sphere such as online health communities where interaction is ongoing

and support is empathic, affective factors that do not involve a logical analysis can have a significant impact on trust formation. These are barely studied. Furthermore, the existing frameworks of trust formation based on IT artifacts (the agent) are unlikely to provide sufficient explanation and prediction of the phenomenon where trust is established through discursive textual conversation (the intermediary of an agent) [Gefen, Benbasat, and Pavlou, 2008]. Therefore, this study intends to bridge the gaps in the trust literature by contributing an understanding on *how trust is formed between users in a text-based relationship-oriented online community*.

The remainder of this article proceeds as follows: we start with a background review on the key concepts in the article, followed by a description of the methodology used to execute the study. We then present the findings from an in-depth study of sixteen online health forum users, and, finally, we discuss the insights and implications of these findings.

II. BACKGROUND

Boundary of Online Health Communities

Based on Wright's definition [2002], an online health community is a collection of small virtual discussion groups in which people with a common concern about a health topic share information, experiences, and feelings and provide support and encouragement to fellow members. The nature of interactions is differentiated from in-person meetings by being text-based only (i.e., no audio or video), persistent (interactions are stored), and anonymous. First-hand experience with a medical condition defines the core of community interactions and the boundary of the group, and interactions concerning this experience are the main source of knowledge [Borkman, 1999]. The dominant role of experience with a medical condition sets online health communities apart from other online communities.

Self-disclosure in Online Health Communities

Self-disclosure is a critical component of activities in online health communities [Klemm and Reppert, 1998; Winzelberg, 1997] and is largely encouraged by the absence of physical cues [Tidwell and Walther, 2002]. Contributors usually disclose their medical condition, medical knowledge, experiences with treatment and medication, and emotional reactions to invite empathic responses from others [Pfeil and Zaphiris, 2007]. The conversation reinforces the shared situation and value of patients for the purpose of helping them relate to their own experiences [Slater et al., 2003]. The narrative storytelling nature of postings illustrates a multidimensional profile of a patient and promotes various coping strategies.

Coping Strategies in Online Health Communities

Research shows that, with the support of family, medical professionals, and other patients, people feel less overwhelmed by the life transition that comes with a serious illness [Cella and Yellen, 1993; Samarel and Fawcett, 1992]. What drives patients to online health communities is not having sufficient support along with the possession of a sense of alienation, feelings of isolation, anxiety about treatment, misconceptions, and misinformation [McKenna, Wellisch, and Fawzy, 1995].

Patients visit online health communities partly to *satisfy informational needs* in order to alleviate the anxiety and stress associated with not knowing and to minimize the chances of relying on false or misleading information. An online health community is viewed as an information hub where people can obtain every bit of information available about a topic [Hu et al., 2012]. In particular, dissatisfied with information provided by their health professionals [Chen and Siu, 2001], some patients and caregivers visit online health communities to obtain a second opinion and practical knowledge from other patients, information that is different from what they receive from professionals and textbooks [Chen and Siu, 2001; Derdiarian, 1987; McMullan, 2005].

Health forums can also provide *emotional support*, allowing patients to alter the way they feel and the way they perceive stressful situations [Nolen-Hoeksema and Aldao, 2011; Thoits, 2011]. To cope with alienation and isolation, particularly caused by ailments which carry social stigma and embarrassment, people exhibit affiliative behaviors, seeking the support of others with similar medical conditions in online health communities [Davison, Pennebaker, Dickerson, 2000]. The frequency of affiliative behaviors increases along with rising anxiety levels in order to maintain a sense of normalcy and accuracy about the patients' world [Festinger, 1954].

Self-disclosure raises the opportunity for patients to identify any similar others. *Social comparison* is applied as a coping strategy to create a sense of self-enhancement and/or self-improvement [Festinger, 1954]. For example, being aware of a less-fortunate case can boost one's subjective well-being and reduce feelings of threat and self-pity [Wills, 1981], while a more-fortunate case implies the possibility of improvement of one's own situation and creates hope and inspiration [Wood et al., 1985].

Another approach, especially when facing an uncertain future, is to *reinforce patients' existing beliefs* by intentionally selecting information. Uncertainty is commonly considered negative and harmful, and humans are driven to reduce uncertainty about themselves and surrounding situations by obtaining more information from all sources [Bradac, 2001]. However, in the health domain, uncertainty is useful and creates hope [Brashers, Goldsmith, and Hsieh, 2002; Huber and Sorentino, 1996]. By deliberately collecting information to increase uncertainty about unfavorable outcomes, individuals can increase their hope of favorable outcomes. Emotional distress can strongly influence this tendency [Nickerson, 1998], and it is not surprising to observe passive coping strategies such as denial and avoidance [Hagger and Orbell, 2003].

Considering these diverse strategic behaviors to combat emotional distress, patients are largely under the influence of emotions when using online health communities. Thus, existing trust-formation models that focus on cognitive factors cannot fully explain trust formation in online health communities.

III. TRUST AS A MULTIDIMENSIONAL CONSTRUCT

Research into trust has tended to conceptualize trust as either (1) a unidimensional cognitive construct that indicates an individual's beliefs about other people based on their characteristics or (2) a multidimensional construct that has both cognitive and affective dimensions.

One Dimension—Cognitive Trust

Many studies follow the research of Mayer et al.'s [1995] conceptualization of trust from an economic perspective, emphasizing the nature of risk reduction, prediction, and reliability [Langfred, 2007; Lankton and McKnight, 2011; Mayer and Gavin, 2005; Williams, 2001; Wu and Tsang, 2008]. This stream of work believes that trust is established based on character-based theory, resulting from deliberate assessment of a trustee's characteristics and weighing the benefits of trusting over risks [Dirks and Ferrin, 2002; Lewicki and Bunker, 1995]. This type of trust constitutes evidence of trustworthiness, which means "we cognitively choose whom we will trust in which respects and under what circumstances, and we base the choice on what we take to be 'good reasons'" [Lewis and Weigert, 1985, p. 970].

Many researchers consider cognitive trust to be multidimensional because it consists of trusting beliefs [Gefen, 2002]. *Trusting beliefs* mean that one believes that the other party has one or more characteristics (i.e., dimensions) beneficial to oneself [Doney, Cannon, and Mullen, 1998; Jarvenpaa, Tractinsky, and Vitale, 2000]. Ability (capability of the trustee to do what the trustor needs), integrity (trustee honesty and promise keeping), and benevolence (trustee caring and motivation to act in the trustor's interests) are critical trusting beliefs that explain a major portion of the variance in trust [Mayer et al., 1995]. Additional research reveals that, compared with ability and integrity, benevolence takes longer to form [Schoorman, Mayer, and Davis, 2007] and is more salient [Ba and Pavlou, 2002] and emotionally associated [Dimoka, 2010]. This difference strongly indicates that, although benevolence has been considered a trusting belief, the underlying theoretic foundation of the link between benevolence and trust is completely different from ability and integrity.

Multiple Dimensions—Cognitive and Affective Trust

The other stream of research on trust criticizes the narrow focus on rationality [Kramer, 1999]. It embraces trust as a "collective attribute" based on the relationships between people that exist in a social system [Lewis and Weigert, 1985]. The "collective attribute" can result from rational reasons and logical assessment (cognitive trust) and from emotional bonding and caring (emotional trust) [Jones and George, 1998; Lewis and Weigert, 1985; McAllister, 1995; Zaheer, McEvily, and Perrone, 1998]. These studies suggest that trust is truly viewed as multidimensional by incorporating both cognitive and affective components [Cook and Wall, 1980; Johnson and Grayson, 2005; Webber, 2008; Webber and Klimoski, 2004]. The multidimensional view acknowledges two fundamentally different components of trust that may have different antecedents and outcomes [McAllister, 1995]. Cognitive trust is rooted in cognitive assessment of others' competence, reliability, and dependability, while affective trust is grounded in emotional bounds, caring, and reciprocity [Cummings and Bromiley, 1996]. This parallels with Jones and George's [1998] conditional trust (drawn from knowledge and positive expectation of others) and unconditional trust (induced by positive affect and mutual identification), as well as Dirks and Ferrin's [2002] character-based and relationship-based perspectives.

Comparison Between Cognitive and Affective Trust

The multidimensional view of trust is further supported by the nature and the development of cognitive trust and affective trust. Several studies discovered that affect induces deeper levels of trust [Lewicki and Bunker, 1996; McAllister, 1995; Rempel, Holmes, and Zanna, 1985]. For example, faith, as the deepest level of trust, is built on affective attachment and the emotional investment of caring [Rempel et al., 1985]. With unconditional trust, short-

term behavioral lapses are likely to be tolerated because shared values direct the orientation of the relationship [Jones and George, 1998]. In the face of trust violation or absence of solid evidence, affective trust is more enduring and stable [Lewicki and Bunker, 1996; McAllister, 1995; Morrison and Robinson, 1997]. It is because emotional attachment can override cognitive assessment and drive people to take risks [Weber, Malhotra, and Murnighan, 2006].

The stability and influence of affective trust can be explained by the way it emerges. Webber's longitudinal study [2008] revealed that cognitive trust and affective trust not only emerge as separate components over time but also are induced by different antecedents. Specifically, cognitive trust emerges at the early stage in a trust relationship, while cognitive trust and affective trust exist together at the late stage [Webber, 2008]. This has been shown experimentally [Dirks, 1999] and is also in line with work showing that initial trust is influenced by non-affective factors such as dispositional trust [Rotter, 1967], stereotypes and categorization [McKnight, Cummings, and Chervany, 1998; Meyerson, Weick, and Kramer, 1996], institutional trust [Lewis and Weigert, 1985; Zucker, 1986], and calculative trust [Lewicki and Bunker, 1996].

In sum, the fundamental differences between cognitive trust and affective trust support the multidimensional nature of trust and suggest that trust is developed through stages. By studying long- and short-term members of communities, online health communities are a suitable environment to capture the full development of trust at various stages.

IV. METHODOLOGY

Qualitative interpretive methods are ideally suited for exploring the rich discourses and ongoing interactions in online communities because they allow researchers to obtain a deep understanding of processes and other phenomena that are difficult to measure [Bowler Jr., 2010; Kozinets, 2010]. They are particularly suitable when the concepts examined are not well-understood, as is the case here.

Theoretical Population and Sampling Strategy

The theoretical population of the study includes people who seek and provide support regarding a specific medical condition from the perspective of patients and caregivers in computer-mediated online health communities. *Online health community* is defined as a collection of small virtual discussion groups in which people with a common concern about a health topic share information, experiences, and feelings and provide support and encouragement to fellow members. Thus, for this study, the sampling population entails patients and caregivers who visit online health forums for medical-related reasons. Online forums are chosen because they specifically exemplify a text-based interactive communication medium and are the most popular tool adopted for the sharing of health information [Lee, Vogel, and Limayem, 2003].

Moreover, *medical* or *health issues* refers to the general condition of a person's body caused by illness, injury, pain, or discomfort. Mental disorders and spiritual health are not included in the study in order to ensure that the negative emotions experienced by patients are caused by physical problems rather than a manifestation of mental disorders or spiritual beliefs. Additionally, focusing on trust toward non-authoritative figures, we exclude those online health forums (OHFs) that are explicitly involved with and moderated by medical professionals, such as general medical practitioners, specialists, and registered nurses. Finally, having acknowledged possible confounding effects of national culture on trust [Doney et al., 1998; Fukuyama, 1995; Hofstede, 1994], we restricted the sampling population in the study to users who are residing in Australia.

A purposive sampling approach was chosen to maximize the diversity of the sample [Miles and Huberman, 1994] with regard to medical conditions, users' experience with forums, the gender and age mix, education levels, and roles (patient or caregiver). A snowballing technique was employed to increase the chance of reaching appropriate potential participants, by asking participants to recommend future interview candidates. Participants were recruited from an Australian university and a number of Australian-based OHFs. Recruiting from a university increased the chance of attracting users who do not have an OHF to visit regularly and who are also important as part of the theoretical population.

Table 1 lists the range of medical conditions of the interview participants. Each condition is described using dimensions derived from the Common Sense Model (CSM) [Leventhal, Meyer, and Nerenz, 1980]. According to the CSM, illness has five dimensions: illness identity (severity of symptoms), timeline (the course of the illness), consequences (the impact of the illness on patients' overall quality of life and functional capacity), cause (biological, emotional, environmental, and psychological factors that are responsible for causing the illness), and likelihood of cure/control (the sensation of empowerment regarding coping behaviors or the efficacy of treatment). Empirical studies show that timeline, cure/control, and consequence can significantly influence coping behaviors and illness

outcomes [Hagger and Orbell, 2003], and their influence also concur with the report from interview participants. Therefore, these three dimensions were chosen to categorize the medical condition. We also included illness label (stigma) in the table, since interview participants mentioned it frequently. The classification of each medical condition is based on the perception of interview participants. It is appropriate since CSM aims to explain how people make sense of and respond to health threats and illness [Leventhal et al., 1980].

Table 1: Medical Conditions That Appeared Among Interview Participants								
	Chronic ongoing	Temporary acute	Manage-able	Cur-able	Stigma-tized	Not embarrassing	High impact	Low impact
Diabetes	X		X			X	X	
High blood pressure	X		X			X		X
Pregnancy		X		X		X		X
Eosinophilic oesophagitis	X	X	X			X	X	
Lung cancer	X		X		X		X	
Spinal injury	X		X			X	X	
Addison's disease	X		X			X	X	
Chronic fatigue syndrome	X		X		X		X	
Degenerative disc	X		X			X	X	
Endometriosis	X		X			X	X	
Fibromyalgia	X		X			X	X	
Minor ailments*		X		X	X	X		X
*Here "minor ailments" is used to represent medical conditions that non-regular forum users have. Non-regular forum users usually locate a forum by Googling and visit OHFs only when symptoms emerge or medical attention is needed. Their short-term visit is usually terminated when they are cured. Some non-regular users in the sample did not disclose their exact medical conditions, and the conditions may be stigmatized as well as *not embarrassing. Low impact* is estimated as minor ailments because the literature suggests that temporary curable conditions are more likely perceived as low impact on life quality.								

In addition, we gathered secondary data from a subset of the OHFs for the purpose of triangulation. Lung cancer, pregnancy, and chronic pain forums were chosen for two reasons. First, most of the interview participants had contributed to one of these three forums. By identifying as many interview participants as possible in the forums, we were able to observe participants' online activities and interaction. The combination of interview and online interaction data gave us a rich data source that allowed us to detect subtle differences and similarities in online behaviors that were crucial to theory-building. Second, the three forums represent distinct medical conditions. Referring back to Table 1, pregnancy is a temporary condition, while lung cancer and chronic pain are ongoing. Between the latter two, lung cancer patients usually carry a stigmatized label, as it is automatically assumed that smoking is the cause, and therefore, lung cancer patients are at least partly responsible for their own condition. Finally, the three forums differ in the characteristics of each forum. The differences will be compared in the "Forum Data" section.

Data Collection

Interview Data

Guided by the research questions and sensitizing concepts from the literature review, a list of interview questions was developed. Interview questions were pretested on two Ph.D. students (whose expertise is health informatics and health education) and two students who are regular OHF visitors. Based on their feedback, refinements and adjustments were made to wording, illustrative examples, the order of questions, and so on. Appendix A provides the guided interview protocol and sample quotes.

In total, the primary investigator conducted one-to-one semi-structured interviews with sixteen participants who represent different medical conditions, length of time using forums, genders, ages, education levels, identities, roles, and purposes (see Table 2). The average length of interview is forty-seven minutes with a standard deviation of nineteen minutes. The first interview was conducted in September 2010 and the last one was in March 2011. The six-month period allowed time for the initial interviews to be coded and analyzed, so that issues needing further

investigation could be detected, and appropriate questions could be devised and added/adjusted in the interview protocol.

To protect participants' anonymity and provide a safe environment, interviews were conducted over Skype and recorded by using MP3 Skype Recorder. Transcription and coding were conducted shortly after an interview was finished. Recruiting was stopped when theoretical saturation was reached, and most of the categories and properties remained unchanged when a new transcript was introduced. It is recommended to have twelve to twenty interviews when intending to achieve maximum variation [Guest, Bunce, and Johnson, 2006; Kuzel, 1992]. During the open coding, both the number and the names of codes did not change significantly after coding the first fourteen transcripts, which indicated data saturation.

*ID number is ordered by the date of the interviews in ascending order.							

Table 2: Demographic Information of Interview Participants

ID*	Gender	Age	Education	Patient/ caregiver	Experience with OHF	Medical conditions	Duration
A1	m	40–50	Bachelor	Patient	1–3 years	Lung cancer survivor	25:16
A2	f	40–50	Master	Caregiver	1–3 years	Husband: lung cancer survivor	39:27
A3	f	60+	Bachelor	Patient	3 years +	Lung cancer survivor	48:55
A4	f	25–30	Bachelor	Patient	1–3 months	Eosinophilic oesophagitis	17:14
A5	f	60+	High school	Patient	3 years +	Spinal injury	64:44
A6	f	<25	Bachelor	Patient	3 years +	Minor temporary ailments	46:10
A7	m	<25	Bachelor	Patient	3–6 months	Minor temporary ailments	37:17
A8	m	30–40	Master	Patient, caregiver	1–3 years	Self: Minor temporary ailments Mom: diabetes, high blood pressure	32:57
A9	f	<25	Bachelor	Patient	6 months–1 year	Minor temporary ailments	20:26
A10	f	60+	Bachelor	Patient	3 years +	Chronic fatigue syndrome	61:37
A11	f	60+	Bachelor	Patient	3 years +	Addison's disease	75:06
A12	m	60+	High school	Patient	6 months–1 year	Lung cancer (12 months)	52:08
A13	f	30–40	Bachelor	Self (was pregnant)	3 years +	Past pregnancy	44:22
A14	f	50–60	High school	Patient	3 years +	Degenerative disc	83:37
A15	f	30–40	Bachelor	Self	3–6 months	Pregnancy	45:38
A16	f	30–40	Bachelor	Patient	3 years +	Endometriosis, fibromyalgia	58:47

*ID number is ordered by the date of the interviews in ascending order.

Forum Data

As supplementary data, 567 postings from forty people in three OHFs were collected over an eleven-week period. The pregnancy and lung cancer forums are large and active, so contributions from ten and eleven active participants respectively were sampled at random from the first five pages of threads to provide a representative snapshot of postings. The chronic pain forum is much smaller, so all postings by the nineteen active participants during the period were collected in an attempt to obtain a similar volume of material.

Where possible, postings from interview participants that could be identified (some of them use their real names as user names), were specifically included in the sample (with the express permission of the participants, of course). In this sample, we have documented six interview participants' postings from two of the three forums. Whenever an informant had more than fifty postings within the period, we randomly sampled twenty postings. The descriptive data (see Table 3) show that the three selected forums not only differ in medical condition but also in membership size, the length of history, and the posting frequency:

- The pregnancy forum has the largest number of members (more than 200,000), has the longest history, is affiliated with and supported by a national media company, is female dominant, and user names are unidentifiable aliases.

- The lung cancer forum has over a hundred users, has the second longest history, is operated by a cancer charity, is gender-balanced, and user names are identifiable: typically the person's real name or a real-name-like alias.

- The pain forum has around fifty members, has the shortest history, is operated by a pain sufferer, is gender-balanced, and user names are identifiable: typically the person's real name or a real-name-like alias.

Table 3: Descriptive Data of Selected Forums Based on the Sample						
Forum	Average posts since joining	Average months since joining	Average postings per day	Size of forum	Number of informants	Number posts extracted
Pregnancy	622.4 (710.79)	28.50 (25.18)	1.53 (2.02)	Large	10	225
Lung cancer	41.73 (52.81)	17 (17.72)	0.12 (0.19)	Medium	11 [3]	196
Chronic pain	7.67 (8.46)	11.53 (6.57)	0.038 (0.041)	Small	19 [3]	146
Note: The figures in the parentheses are standard deviations. The figures in brackets indicate the number of interview participants identified among informants.						

Data Analysis

Data analysis is based on sixteen interview transcripts and 567 forum postings. The interview data were given more weight in the analysis than the forum data because the questions underlying the interview data were designed to address the research questions directly. Nevertheless, data from both sources were coded together using a method based on grounded theory's open, axial, and selective coding [Strauss and Corbin, 1990]. This iterative coding process was facilitated by computer software, with the dataset coded twice by the primary investigator using Excel and NVivo 8. The codes were affirmed by additional investigators, both individually and in team meetings, to resolve differences of opinion regarding the meaning of each data point analyzed. This multiple-assessor process ensured inter-rater agreement and sufficient depth of analysis that the process model extends existing theory. From September 2010 to April 2011, Excel was used to manage the data. After a month of writing up the first draft of the study, from June to July 2011, the primary investigator coded the data assisted by NVivo 8. Not surprisingly, the two coding processes generate almost identical categories (e.g., antecedents of trust) and subcategories (e.g., familiarity, perceived information credibility, perceived similarity, and so on). However, the coding obtained via NVivo 8 is far superior due to its more flexible data sorting, display, and labeling options. These advantages enabled us to reveal dimensions of trust and their relationships to trust antecedents that were not evident in the first round of analysis. This iterative, multi-rater process has also allowed us to assess alternative process models at length, particularly models involving one, two, or four distinct processes, and jointly reject those possibilities as not viable, given the patterns observed.

The data were coded through three stages and analyzed systematically (see Table 4). In Stage 1, data were reduced into labeled coding units immediately following transcription of each interview. Under the coding method employed, a coding unit can be a word, a phrase, a sentence, or even several sentences, and the label assigned is a brief term that describes the underlying concept in that unit. Some codes were generated based on the interpretation of the primary investigator, such as "confirm with self-knowledge" and "learn about the person." Some codes were produced in an in-vivo manner by synthesizing what participants reported, such as "crowd consensus" and "logic soundness," and the remainder was developed by sensitizing existing concepts. For example, "perceived similarity in medical status" and "perceived similarity in values" are derived from "status homophily," and "value homophily" concepts derived from existing research. Concepts were constantly compared against each other for similarities and differences to decide whether or not each label should be modified. By the end of Stage 1 coding, we had generated 136 labels.

The second stage of coding was to identify underlying relationships between labeled concepts and to organize them into tentative conceptual categories. It started from the middle of the interviewing period and influenced the time spent on each question (e.g., some questions probing less-relevant concepts were cut short/out). The raw data were revisited to evaluate conditions and context of each concept and decide whether it can be placed into a category. For example, in Table 4, we used perceived empathy as an example to illustrate our coding and analysis procedure. The category "Examples of empathy" comprises three concepts "Empathy," "Show caring," and "Best wishes." The core notion of empathy is to understand how the other feels. The three concepts reflect the ways that we can observe empathy: (1) illicit the same feelings by similar experience, (2) share understanding, and (3) show good intention. "Empathy leads to trust" consists of two opposite responses, and the negative cases can be explained by "Validation" because only genuine empathy shown in an appropriate way can induce trust. By the end of Stage 2 coding, we had condensed the codes into thirty-eight categories.

Stage 3 coding	Stage 2 coding	Stage 1 coding	# Quotes/ postings	Samples of quotes/postings
Table 4: An Example of Data Analysis				
Perceived empathy (Trust antecedent)	Examples of empathy	Empathy	7	*Quite often I read people get turned away at 3 a.m. by the hospital or the doctors because they're in such agonizing pain and they can hardly walk. It's just uncalled [for] to consider them junkie, hospital shopping. It just makes me so angry. It happens to me, and the forum is the place you can go to vent* (p. 4, A14).
		Show caring	334	*Glad you are feeling better. I suppose now it is being cautious and if there is any chest pain or coughing straight seek medical attention. Hang in there you are doing a great job. Just remember how you felt the week of surgery and how much you recover in 4 weeks and look forward to getting stronger in the next few weeks before Chemo. Love D* (LL69, D).
		Best wishes	54	*Anyway reading and lurking and hoping all of u get some relief even if only occasionally* (PL2, P).
	Empathy leads to trust	Leads to trust	6	*Because of the emotion [I would trust him more] and I also look if the information makes sense* (p. 4, A8).
		Does not lead to trust	2	*I don't know [if they're showing empathy]. I think they're just talking about their own experiences* (p. 7, A2).
	Validation	Genuine care	8	*Any support, emotional support, it helps, as long as it's genuine* (p. 2, A5). *Sometimes I feel it's little dodgy that he wants to know what you or your friends got and I'm not looking for any emotional support as much as to find out what other people have done with their problems.... If compassion is too unnatural or they want too much to be emotionally connected, I don't like it that much* (p. 3, A9).

The last coding stage is to select categories that directly address the research question and weave those concepts into an overarching theory. For example, based on the analysis, privacy concerns do not affect users' intentions to contribute because they are in control of how much information to reveal, so this category was removed. The Stage 3 coding took place near the end of data analysis alongside the final trust framework.

V. RESEARCH FINDINGS

The analysis of the data revealed three processes that delineate how trust is formed in OHF and a number of antecedents and behavioral outcomes associated with each process (Figure 1).

- *Process 1: Credibility-based trust formation.* Using this process, the object of a forum user's evaluation is a single posting. The behavioral outcomes are induced solely from the assessment of information credibility.

- *Process 2: Cognitive-Affective-based trust formation.* Using this process, the focus of evaluation shifts from the attributes of a posting to the trustworthiness of a person, and subsequently, the user becomes a trustor. The behavioral outcomes are the result of the propensities of trustor, perceived information credibility, familiarity, perceived similarity, and perceived empathy (see Figure 2). As Process 2 is complicated and overlaps with Processes 1 and 3, a more detailed analysis of Process 2 will be presented later in the article.

- *Process 3: Established trust formation.* Using this process, a trustee is viewed as a trusted source of support and a shortcut for credible information without scrutinizing.

Process 1: Credibility-based Trust Formation

In Process 1, a forum user's focus is individual postings. The main intention is to solve the emerging problems, resolve ad-hoc questions, and check out additional information to update knowledge or self-diagnose by reading and analyzing postings. One participant stated the motivation for using OHFs:

I think, given that there are quite a few people having cancers, it's really a good way to seek treatments, to see what the treatments they are on, to have an idea of the latest studies, or what the doctors are doing differently than those tending to my husband (p. 1, A2).[1]
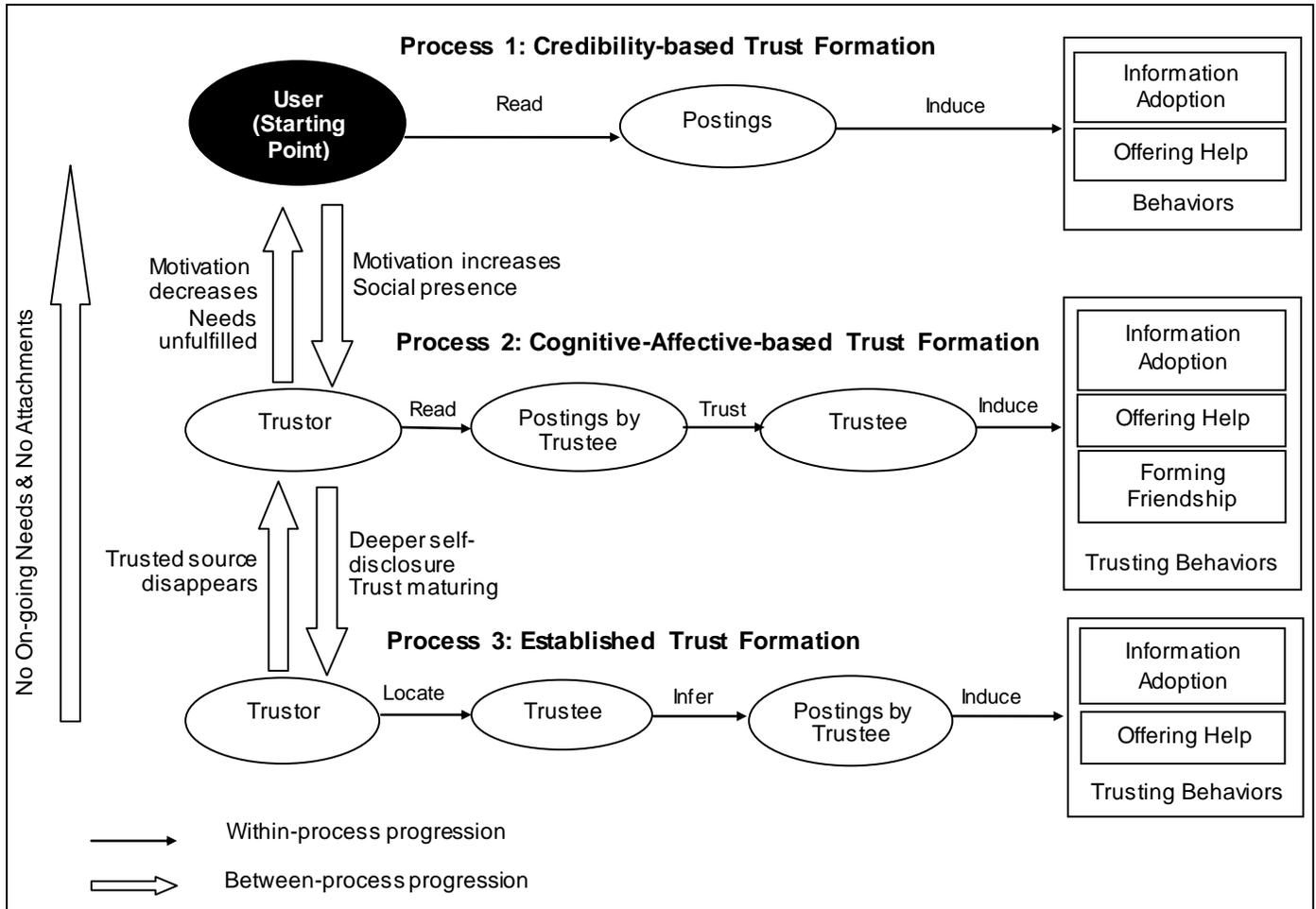
Process 1: Credibility-based Trust Formation

User (Starting Point) —Read→ Postings —Induce→	Information Adoption / Offering Help / **Behaviors**

Motivation decreases Needs unfulfilled

Motivation increases Social presence

No On-going Needs & No Attachments

Process 2: Cognitive-Affective-based Trust Formation

Trustor —Read→ Postings by Trustee —Trust→ Trustee —Induce→ Information Adoption / Offering Help / Forming Friendship / **Trusting Behaviors**

Trusted source disappears

Deeper self-disclosure Trust maturing

Process 3: Established Trust Formation

Trustor —Locate→ Trustee —Infer→ Postings by Trustee —Induce→ Information Adoption / Offering Help / **Trusting Behaviors**

→ Within-process progression

⇨ Between-process progression

Figure 1. Trust Formation Process Framework

Users in this process heavily rely on search engines to locate relevant forums and tailored information, and may not have a specific forum to visit repeatedly. Consequently, due to the narrow concentration on postings themselves, users overlook the characteristics of those who write the postings and cannot identify other users individually or have whole knowledge of them or their medical condition, as a participant stated:

I normally have a particular problem. I basically look for relevance and the quality of information. When I Google it, I usually scan through and click about seven or eight links. And I read the first page to see its relevance and information quality because the first page should be the most relevant to the search term (p. 2, A6). [She added:] *I haven't had much experience to familiarize myself to those online forums since I don't use a particular forum regularly* (p. 5, A6).

Therefore, the behavioral outcome is merely based on the credibility of information, whether information makes logical sense and whether it can be validated. A participant explained:

The advice is from their experience. If the advice makes sense and many people give me the same advice, I would ask around to see how my friends, family or other people online think. I would also search on the Internet and check with other sources (p. 4, A8).

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[1] Quotations from the interview data are listed as the page (P#) of transcript of participant (A#).
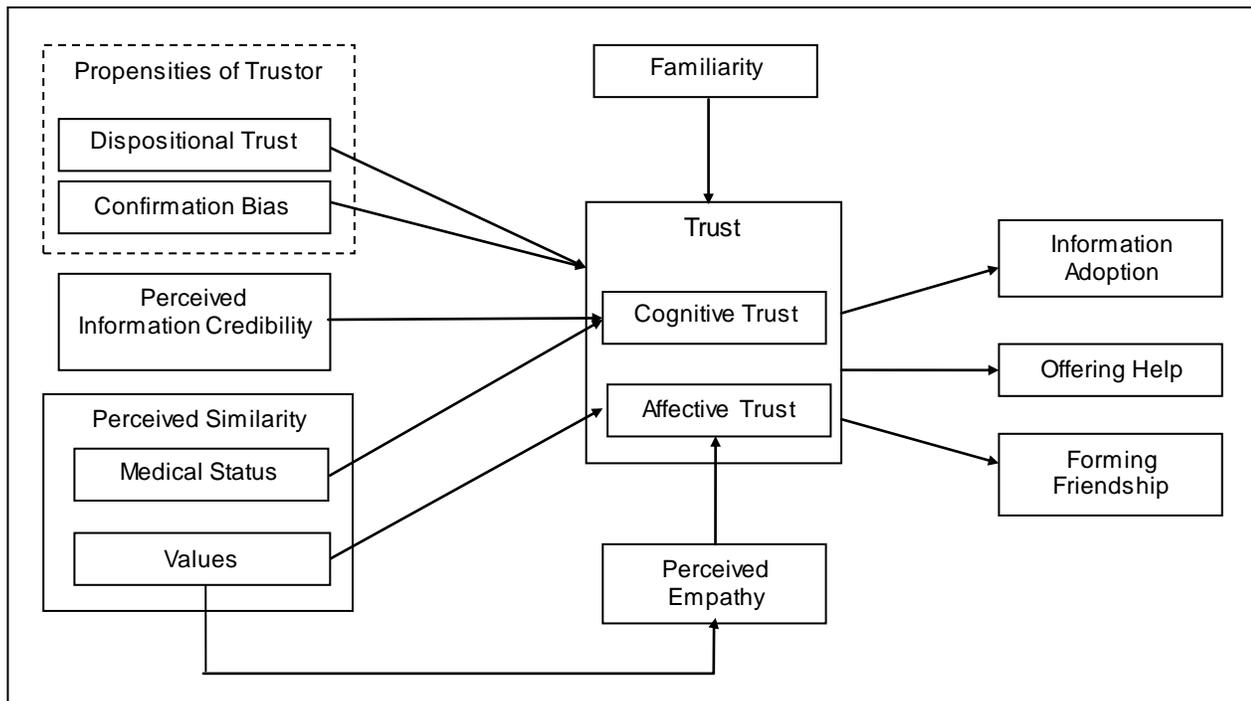
Figure 2. Process 2: Cognitive-Affective-based Trust Formation

Process 2: Cognitive–Affective-based Trust Formation

In Process 2, a forum user focuses on both the credibility of a posting and the characteristics of the person who writes it. Through continuous observations and interactions, the user may be able to differentiate familiar users from strangers, with the assistance of recurring user names or avatars, consistent writing patterns, similar experiences, or memorable impressions. The behavioral outcomes depend on information credibility and an overall evaluation of a contributor: if both information and contributor are assessed as credible, the user will become a trustor. One participant confirmed the combined influence of information credibility and trust:

I would follow the advice if I agree with it. If I have advice to take certain medication or something like that, and I thought that was considerate reasonable advice and I'll take that idea on board. I guess 60% resides in logical sense and 40% would be based on my trust of that person (p. 7, A6).

The data reveal that the trustworthiness of a contributor is assessed based on the propensities of the trustor, the perceived credibility of the contributor's postings, familiarity with the contributor's past postings, perceived similarity with the contributor, and perceived empathy from the contributor. Possible trusting behaviors include information adoption, offering help, and forming one-to-one friendship. Details of each factor will be described below.

Propensity of Trustor

A trustor's propensity to trust is conceptualized as a form of two personality traits: dispositional trust and confirmation bias.

Dispositional Trust describes a consistent tendency to trust a broad spectrum of situations and persons [McKnight et al., 1998]. One participant indicated her tendency:

I've been a librarian for many years before I got sick. So I used to teach people [about] being distrustful to medical literature, reading carefully, looking how many people have been surveyed and how many people have dropped out, etc., so I'm not really trusting regardless (p. 1, A10).

Confirmation Bias is a tendency to favor information that confirms a person's existing beliefs or hypotheses irrespective of whether the information is true [Plous, 1993]. Ideally, people should seek evidence from multiple sources and evaluate the evidence objectively, giving lower weight to anecdotal evidence than rigorous large-scale studies. However, when encountering emotionally significant and complicated issues that can conflict with or challenge established beliefs, an individual is motivated to selectively collect supportive evidence, intentionally omit

conflicting information, or overweigh evidence that affirms their existing attitudes or positions [Nickerson, 1998]. In the data, confirmation bias appears in two ways:

1. At the early stage when a user searches for hope: "*Initially I was trying to get hope to see if anyone has beaten it and survived it. None of them have [survived more than one cancer]. This is the fifth cancer [of my husband], so then I wanted to see if anyone has been alive for more than two months or six months*" (p. 2, A2).

2. During the darkest moment when there is nothing to lose: "*Sometimes I do get to that point that the pain is just so bad that if someone tells me to take A mixed with orange juice to make myself better, I'll do it. We all get to that point at some stage*" (p. 6, A14).

Nevertheless, when one is rational, confirmation bias is less influential: "*I wasn't seeking confirmation about taking the treatment or not taking the treatment. I was seeking facts and their experience*" (p. 5, A1). Similarly, another emphasized: "*I want to make an informed choice so I have to have both good and bad [information]*" (p. 5, A14).

Perceived Information Credibility

Perceived information credibility is one factor that affects cognitive trust. In more than half of cases, participants based assessments of information credibility on the perceived trustworthiness of contributors and active seekers. Both heuristic cues (e.g., literary competence of a contributor, the credibility of cited source, crowd consensus) and cognitive assessment (e.g., logic soundness, verifiability) are employed to evaluate information credibility and infer the trustworthiness of a contributor or an active seeker.

I *sort of trust people with good grammar and [who are] more assertive* (p. 1, A3)*…. How they write it, if it's written well, punctuated, spelt correctly. Those people who seem well-educated I would think more trustworthy than those who do not* (p. 3, A9).

I prefer the majority ideas. But if there is only one person [who has] answered, I'll be reading his post and, based on my judgment that he's a rational person and [that] what he says makes sense, I'll try (p. 8, A10).

For experiential knowledge, a trustor appears to be more trusting and tolerant. One reason is the subjective nature that increases the difficulty of verification:

When you find scientific information, I would take the source into account; for more subjective information like people's experience … there are so many differences and variation … that kind of subjective information I trust and seek more because people don't really have reason to lie about that (p. 1, A6).

The importance of heuristic cues becomes insignificant when assessing experiential knowledge.

It doesn't matter if people can't spell or their grammar is incorrect, they still suffer pain. If they cannot articulate what happened, if it's very basic, I'm very thankful they gave me their opinion and told me how it affects them (p. 7, A14).

Familiarity

Familiarity is an understanding, often generated from previous interactions, experiences, and learning of what, why, where, and when others do what they do [Gefen, 2000]. In OHFs, there are potentially more people to interact with than one could manage in a lifetime. Nevertheless, forum users do familiarize themselves with specific others' medical conditions and progress through reading their postings and interpreting any behaviors in context.

For example, one participant has both fibromyalgia, which causes chronic pain and depression, and endometriosis, which is associated with infertility. When she had a surprise pregnancy and sudden miscarriage, she was very emotional because she suspected that the anti-depressant medication was the cause and wanted to get off it. Her dramatic reaction was interpreted as normal rather than attention-seeking because others were familiar with her medical condition and knew how much she wanted children. They believed her story, and offered consolation and practical advice to assist her with her condition and family life.[2]

Familiarity with the trustee as a person, not just someone with a shared medical condition, was also seen to develop, with informants commenting on how they became familiar with the style, personality, likes, and dislikes of some fellow contributors:

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[2] It is a summary of a thread of postings (PL104 -113, J, G, SM, V, S, A).

I wouldn't know them before. Those people who have been in the forum for [a] long, long time, you get to know them even if you never met them. You get to know their views, whether they research things, or whether they just read something on the newspaper saying this is what they really know. But some members in the forum are very knowledgeable and do a lot of research. I trust what they say (p. 4, A3).

[W]hen they have responded to certain people, I suppose it's exactly like when you meet somebody. And when you get to know them, you may in fact like them more and more, trust them more and more.… I judge [them] by what they wrote before, how they thought, and how they responded to other people (p. 6, A11).

Perceived Similarity

Looking for people with similar medical condition is common in OHFs [Wright, 2000a, 2000b; Wright and Bell, 2003]. Similarity in medical status and similarity in value emerged from the data. *Similarity in medical status* includes ascribed characteristics (e.g., age) and acquired characteristics (e.g., medical condition, medication/treatment). It is the first step in assessing relevancy:

Somebody recommended a certain kind of treatment that is good for cancer. My next question is what sort of cancer…. If it turns out they got prostate cancer or breast cancer, what [treatment] they have may not be beneficial to me at all (p. 7, A11).

Similarly, another participant commented: *"… If I have to guess what my experience was I [would] look [at] someone who got similar situation as me like same age, same gender, under the same medicine" (p. 4, A6).*

However, sometimes it is possible to have only a very approximate similarity due to the nature of diseases. For example, *"[Addison's disease has a] very wide range of symptoms, up to sixty. It hits people in different ways. Its severity is very variable. And it's always come and gone"* (p. 3, A13), and an illness like Eosinophilic oesophagitis has "*various conditions and there are lots of difference and phases so there is not really a person having the exactly same condition as me*" (p. 1, A4). Therefore, the similarity in medical status may have wide variation.

The perceived similarity in medical status is reported to contribute to cognitive trust in the data. The shared experience implies that the contributor has the knowledge-base and intention to give support:

You talk to people with a similar range of symptoms. I'll trust more of those people because they know how to deal with them since they've gone through it themselves (p. 6, A10).

Because people are in the same situation, they're more likely to have the good intention to help me (p. 1, A2).

Moreover, shared medical status is the foundation for validation. Having the same medical status, a trustor can dispute or confirm a trustee's story with confidence:

I tend to be drawn or believe those people who are similar because I know what they say [is] true, I suppose. Because I'm experiencing what they're [experiencing] (p. 5, A5).

Similarity in value encompasses attitude, values, beliefs, and any other internal states that can shape our future behaviors. The internal states are expressed through the discussion of other matters (e.g., family, work, pets, hobbies, books, politics, and inspiration).

We share a lot of hobbies and interests because it's the nature of people (p. 7, A10). *… We share books we read. Some of others share ideas on textiles. I may share what I find from geology research which is my hobby* (p. 8, A10).

In addition, the data suggests that the perceived similarity in value can contribute to affective trust. The perception of similarity can elicit attraction and increase a person's tendency to be persuaded in communication [Walther, Pingre, Hawkins, and Buller, 2005]. People who share common values tend to perceive each other positively and trust each other [Kramer, 1994]. It is because people usually feel more comfortable when their values are confirmed by others [Byrne and Clore, 1970; Infante, Rancer, and Womack, 1997]:

It could be something as simple as their humor. And it can be something that I experienced, something they described almost word to word like my experience. There are some people over the years you just draw to (p. 9, A11).

I actually told B about S because there is something about him [that] just strikes the cord with me. I said to D it's just something about S draws to me as a person…. I said I need to meet him … and we made an arrangement to meet and we spent a day together (p. 11, A14).

Perceived Empathy

Perceived empathy is an inference of the thoughts and feelings of others, generated from a person's observation, memory, knowledge, and reasoning [Comfort, 1984; Ickes, 1997]. Affective empathy can be induced by recalling a similar experience or simulating a similar situation and see what emotional feelings it evokes [Goldie, 2000]. By experiencing a similar situation, the consequent emotions can be understood, indicating that the relationship between perceived similarity and affective trust can be mediated by perceived empathy.

Though all your friends can support you, unless someone has been there, is going through or is cured, your friends can't really understand. They can empathize and sympathize, but they don't fully understand (p. 1, A14).

I haven't told anyone about my husband having the fifth cancer because everyone just treats you like dying. It's like a funeral. No one understands. But I told those people who [are] going through the same thing because they understand (p. 6, A2).

The association between perceived empathy and affective trust can be explained by Reeder's "extensive benevolence" [1998]. Perceived empathy can induce affective trust through three stages. In the first stage, *perceived empathy* can be delivered through an empathic message: "*I have also felt the impact of nature as in a miscarriage/ stillbirth. The pain is VERY personal and immeasurable. Many years later, I can still transport myself to the time when I gave birth to my very prem[ature] baby boy*" (PL108, V)[3]. The recipient can perceive whether the contributor feels for him/her through the description of similar situations, feelings, and thoughts.

The next stage is *perceived sympathy*. A recipient believes that a contributor can vicariously experience his/her feelings and dislike his/her suffering. One contributor stated: "*Now I'm the old timer [a lung cancer survivor] and it seems everybody else [is] new and they ask questions. Sometimes I feel so sad because I don't know the answers they want. And I just hope somebody else can answer them*" (p. 1, A3). The sympathy can be delivered through textual content: "*I am sorry for your loss. I'd been following B's posts but had not logged on in a while and was saddened to hear of his passing. It is a terrible disease. I hate it. I'm so sorry that you are going through this*" (LL23, L). The contributor can signal his/her sympathy by disliking the recipient's experience, convincing the recipient that the contributor is sympathetic.

The last stage is *perceived benevolence*. A recipient perceives a contributor as benevolent when the contributor demonstrates sympathy, and action or willingness to improve the welfare of the recipient. One participant described her experience of benevolence:

It was two years ago. I was having my treatment and everything was going well and then my husband got cancer as well. His was very very aggressive and he got sick very quickly and died after three months. I put on the forum. He didn't have lung cancer. I got so many replies from people who are thinking about me and hoping that I get through it. I found it really helpful when I was really really low but I have all these people who I never met genuinely care about me. And I also had phone calls from those I knew (p. 7, A3).

Because perceived benevolence encapsulates the previous two stages and intention to help, it shows concern, support, and caring. Humans have the universal tendency to seek closeness, to be attached with another person, and to feel secure with people who support and care about us [Bowlby, 1990]. This tendency has been demonstrated since we were born and attached to the mother [Bowlby, 1969]. Thus, caring and emotional bonding can form affective trust.

However, not all participants confirm the relationship between perceived empathy and affective trust. The analysis on the negative cases reveals that the causal relationship is valid *only* if empathy is perceived as genuine and honest.

It [the decision of trust] depends on [whether] the feeling is appropriate. If it's appropriate and well-expressed, then I'll maybe trust 50 to 60% more than someone who shows no empathy at all and just [gives] plain information. If someone shows inappropriate empathy in a sense of too abusive, negative or

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[3] Quotations from the forum data are listed as the forum initial, the number of posting (L#) and the subject's alias initial.

lame, expressing way out of proportion or in a useless way like saying I feel sorry for you but didn't give any information, I would trust it 80% less (pp. 6–7, A6).

The genuineness can be signaled by the amount of effort made to disclose similar experiences:

Probably by going to more details and writing more, especially if someone has been through the same thing. If they write they've been through the same thing and I know exactly how you feel, and I feel sorry for you and this is what I find helped me. That means a lot for me. To me that conveys a lot more empathy and a lot more sympathy (p. 9, A13).

Another way is to actively improve one's current situation by offering practical useful advice:

Emotional support is important. But how can you say if you only have emotion but leave out knowledge? All you can say is that I'm so sorry that you feel so ill and feel so lost. What else can you say? Sometimes that can really help a person but I'm essentially a very practical person.... I tend to respect those people who manage to give emotional support and knowledge as well. This is my experience. I really respect people doing that (p. 6, A11).

Trust-related Behaviors

A behavior is induced by trust when the behavior makes a trustor vulnerable to a trustee's future actions that are beyond the control of the trustor [McKnight, Choudhury, and Kacamr, 2002a, 2002b]. In the study, information adoption, offering help, and forming one-to-one friendship are three emerging trust-related behaviors. *Information adoption* can be explicitly acknowledged from the forum data. For example, "*I have taken on board your comments and suggestions*" (LL5, B); "*You are right, I haven't thought about those questions*" (PL129, J).

Second, it can be confirmed when someone comments on the result of applying advice:

I have terrible morning sickness to start with…. A lot of people gave me advice about it and most of the advice was rubbish. I have very low blood sugar and I need to eat a lot of sugar and protein and it's the only way I won't faint. People just keep telling me to eat dry biscuit and I end up throwing up (p. 3, A15).

Similarly, *offering help* is demonstrated as providing a solution to a question or problem, particularly if the advice is explained in a way that the problem owner can understand:

I think you are having a pretty normal initial reaction [to the diagnosis]. At the moment you have little else to focus on except the diagnosis, but once you start treatment your mood should lift…. Usually a treatment program is individually tailored and it often takes time to get everything in place. Until then you need to concentrate on maintaining your level of fitness. Your G.P. [General Practitioner] should be able to help with insomnia (LL4, C).

Meanwhile, in the absence of questions, a contributor can inform specific individuals that he/she is willing to help in the future: "*If I can help in any way, just ask*" (PL14, S); and "*if you need further help feel free to PM [private message] me (otherwise I might forget!)*" (EL74, A).

Depending on the levels of self-disclosure, *friendship* varies in degrees. The friendship can be shallow: "*There are people, I would say now are my friends, only because we all got the same problem. I don't think we have any plans to meet those people at any time other than [in] the support group*" (p. 9, A12). The virtual relationship can be extended to offline: "*There is a group of us we used to meet up offline. We found we lived most in Melbourne, one from Adelaide wanted to meet us. There used be a group of five of us we used to meet up*" (p. 2, A3). Also, like any relationship, friendship can become more profound: "*I have them at my door since I've known them over the years and when I see them I feel that I['ve] know[n] them for years*" (p. 2, A5).

Nonetheless, not everyone is able to form friendships with others in the forum. In the sample of sixteen subjects, seven participants who self-reported "skeptical" do not have any close relationship with people in the forums. Conversely, among the rest of nine participants who self-reported "trusting," five participants who have long history with OHFs (more than three years in the sample) confirmed that they had close relationship with some users in the forums. Four participants who either use forums to fulfill ad-hoc needs or have a short history with OHFs (less than three months in the sample) do not have any close relationships with others in the forums.

The pattern suggests that dispositional trust and familiarity may be the two contingent factors. A trusting nature determines that a trustor is tolerant of uncertainty and potential risks:

[Forming friendship on the forum] is just natural for me. That's how I met my partner from the chronic pain website and we are the only people living in Melbourne (p. 8, A16).

And familiarizing over time gives a chance to brew friendship:

Three or four from the forum call me and visit me. After you get very close to someone online after talking long enough, you would trust them…. It took me 8 months to be friendly with the first one and started to exchange personal stuff (p. 9, A5).

Process 3: Established Trust Form

In the previous section, Process 2 portrays the inference of information credibility to the trustworthiness of a trustee. In Process 3, the direction of the inference reverses. A trustworthy trustee, after passing a series of evaluations, successfully wins the trust and is viewed as a trusted source of support. Rather than repeat effort-consuming assessments each time, a trustor can look for trusted contributors to obtain credible and tailored support as a shortcut. For example,

If I need to find out where to go to find out a particular drug or whatever, he's the one will say try here or try there. 9 times out of 10 he's right" (p. 2, A14) [and] *If it's a poster that I've seen posted a lot and I value her judgment, I'm not gonna analyze that kind of thing [because] she actually knows what I'm going through and what she says is quite believable and I'm happy she's supporting me* (p. 8, A13).

Process 3 depicts the situation that the more credible a source is perceived, the more likely that its information is perceived credible and thus people are more likely to adopt the information. A credible source of information can be a trustee passing the cognitive assessment and having a proven record; it also can be a caring friend through emotional bonding whom one first turns to for help:

Vicky [is] my friend here. I had a very bad period and I rang her and I never had to tell her that I had a bad day. She let me talk it out. It could be one thing that has bothered me for 12 months and nothing improved. She will still talk to me and listen. If I say what should I do about it, she'll say what you need to do is to do your pros and cons. She won't make a decision for me (p. 9, A14).

VI. DISCUSSION

We conducted a qualitative inquiry to uncover how trust is formed in online health communities. We highlighted the difference between online health communities and the rest of virtual communities, and emphasized user-generated content in an environment where no authorities or objective standards are available. The findings showed that trust is developed through three processes. In Process 1, forum users mainly rely on an unemotional or logical judgment of postings to decide their future behaviors; in Process 2, users turn into trustors, and their future behaviors depend on an overall evaluation of an individual's trustworthiness based on multiple factors; in Process 3, trustors' behaviors are strongly influenced by their prior knowledge of a trustee.

We contribute to the literature by developing a dynamic process theory[4] of trust formation. The most common theories in information systems research are variance theories, which focus on correlations and causal relationships between constructs [Shanks, Bekmamedova, and Johnson, 2012]. The existing trust models that explain the relationships among antecedents, trust, and outcomes are variance theories. On the other hand, the framework describes the formation of trust as a set of dynamic developing processes. Process theories, which are relatively scarce, explain dynamic phenomena [Mohr, 1982]. They center on event chains that show how the values of constructs change over time [Weber, 2012]. Rather than viewing associations between constructs as a static state, process theories incorporate time as an essential vector and conceptualize phenomena with classes (of things), attributes, states (a set of values at a point in time), and events (changes in the values of attributes) [Shanks et al., 2012].

In the framework, users/trustors, postings, and trustees are the classes with a range of attributes, and each process is a state. The process framework is a hybrid with variance models in each state, and attributes are depicted by variables. Previous studies [Abdel-Hamid and Madnick, 1989; Newman and Sabherwal, 1989; Poole and DeSanctis, 1992; Sabherwal and Robey, 1995] have demonstrated that a process theory can explain how states change over time through events in sequence while the embedded variance models can describe relationships among attributes,

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[4] *Dynamic* used in this article refers to continuous and changing. A dynamic process theory indicates that the progression of states is continuous over time and can be in either direction. It differs from other process theories that can only move forward and lock in one state. So the dynamic process theory proposed here is a process theory that delineates state changes in certain orders, but not a dynamic theory that consists of conditions influencing each other and the central construct, but overlooks the time sequence.

the advantages of which neither a pure process model nor a pure variance model can achieve [Shaw and Jarvenpaa, 1997].

Because postings are the intermediary of any communications in an online health community, every forum user starts from State 1. The event at this state involves the understanding that the perception of information credibility (an attribute of postings) influences a user's attribute—behavioral outcomes (i.e., information adoption and offering help). The causal relationship between perceived information credibility and information adoption has been well-supported empirically [Cheung, Lee, and Robjohn, 2008; Fadel, Durcikova, and Cha, 2008; Sussman and Siegal, 2003; Zhang and Watts, 2003, 2008]. We expand this line of work by including contributors (i.e., users who give advice) and their behavior in the model. Contributors can decide whether to offer help by evaluating the honesty and emergency of a request. Once a contributor detects an exaggeration or fabrication in a posting, the contributor may choose to ignore it.

In this state, group attachment can be formed when a user is able to generate in-group attachment and out-group discrimination consciously [Locksley, Ortiz, and Hepburn, 1980; Tajfel, 1981; Turner, Sachdev, and Hogg, 1983]. The strength of group attachment depends largely on "the extent to which one knows, likes, and feels similar to other members of the group" [Prentice, Miller, and Lightdale, 1994]. Thus, a strong group attachment, which leads to site loyalty, is usually observed in a homogeneous online community.

In State 2, the events conclude that a trustor's propensities of trust (i.e., dispositional trust and confirmation bias), a trustor's familiarity, perception of similarity, and empathy of a trustee influence the trustee's trustworthiness, and eventually impact the trustor's trusting behaviors. Several theories have been sensitized to support the events.

First, dispositional trust has been well-confirmed as a personal trait that determines a person's trusting nature [McKnight and Chervany, 2001; McKnight et al., 1998]. Second, confirmation bias [Nickerson, 1998; Plous, 1993] and self-validation hypothesis [Petty, Brinol, and Tormala, 2002] explain that patients would trust contributors whose information may be biased but facilitates a coping strategy. Third, the interplay between information credibility and source credibility [Fragale and Heath, 2004; Slater and Rouner, 1996] is used to establish the association between information credibility and trust. Fourth, Luhmann's familiarity theory [1979, 1988] illustrates that increasing familiarity provides a more reasonable expectation of a trustee's future behaviors, and thus, a trustor has more confidence to trust. Fifth, the findings of similarity in medical status is consistent with the categorization process [Brewer and Silver, 1978; Langford, 2002; McKnight et al., 1998; Meyerson et al., 1996], explaining that patients use a shared medical condition as a heuristic cue to reduce the complexity of trust assessment; psychology research on the positive influence of similarity on attractiveness [Byrne and Clore, 1970; Infante et al., 1997] and persuasive communication [Langford, 2002] resonate with the emerging findings that similar value can evoke bondedness and caring. Finally, Reeder's approach to "extensive benevolence" [1998] points out that empathy is an essential factor to enable compassion and caring.

In State 3, the events suggest that a trustee's trustworthiness indicates the perceived credibility of information in a posting, which consequently leads to a trustor's trusting behaviors. Trust can be viewed as the result of history-dependent interactions [Kramer, 1999; Lewicki and Bunker, 1995]. The accumulated knowledge of a trustee's capabilities, values, and behaviors through interaction allows a trustor to build trust based on cognitive assessment and affective response [Williams, 2001]. Once trust is fully established and mature, a trusted contributor can be viewed as a credible source for credible support [Slater and Rouner, 1996]. The established trust is similar to unconditional trust, where both parties have assured each other's trustworthiness by undergoing repeated interaction, and relationships become significant and value-laden. Occasional behavioral lapses are forgiven but emotional outbursts are likely to happen as a signal of broken trust [Jones and George, 1998].

In both State 2 and State 3, member attachment can be formed based on the connection to other members. Once a trustor's affective trust is formed toward a trustee (i.e., emotionally attached), member attachment is formed. It usually arises after group attachment is established and appears stronger than group attachment [Prentice et al., 1994]. Member attachment becomes stronger when the relationship between a trustor and a trustee is strengthened in State 3.

Moreover, a state can transit to another influenced by necessary conditions. From State 1 to State 2, several factors can trigger the move:

1. Motivation. Information processing literature suggests that individuals are motivated tacticians whose information processing strategies depend on their motivations [Fiske, 2004; Petty and Cacioppo, 1986; Petty, Cacioppo, and Schumann, 1983]. In State 2, a trustor has to conduct a comprehensive evaluation besides information itself, so State 2 requires more cognitive effort than State 1. When a user is motivated to

exert more effort (e.g., needs become complicated; the stake of taking advice gets higher), the user can move to State 2, engaging in a more comprehensive cognition-consuming assessment.

2. Social presence. Social presence refers to the awareness of a person being present in an online environment [Short, Williams, and Christie, 1976]. As a vital element in online interaction, social presence has been shown to impact user satisfaction [Gunawardena and Zittle, 1997], depth of online discussion [Polhemus, Shih, and Swan, 2001], and online learning and interaction [Tu and McIsaac, 2002]. Having an identifiable user name, avatar, signature, and profile could increase one's social presence and thus increase the chance, frequency, and depth of online interaction. Another way is to reduce the group size and increase the frequency of social presence exposure by dividing a forum into multiple subgroups, because larger group size makes social presence less effective [Tolmie and Boyle, 2000].

From State 2 to State 3, two indicators affect the progression:

1. Deeper self-disclosure. Social penetration theory [Altman and Taylor, 1973] and relational development model [Knapp, 1978] illustrate that a relationship is developed through stages based on the depth of self-disclosure. The deeper the self-disclosure, the more vulnerable an individual is to the counterparty, deeper trust is needed to sustain. The disclosed privileged knowledge may depart from medical relevance and move toward a more personal and private direction. Each self-disclosure tests the trustworthiness of a trustee and can intensify the relationship. As a result, the trustor can bond to the trustee.

2. Established and mature trust. Trust can be accumulated along with repeated interaction and observation with positive outcomes [Kramer, 1999; Lewicki and Bunker, 1996]. Once trust is fully established and mature, experimenting and evaluating evidence is no longer needed.

The progression can also take the reverse path. When the trusted source disappears (e.g., trust is broken; a friend unfortunately passes away or leaves the forum), a trustor may move back to State 2 looking for another trusted source or even leave the forum completely if the emotional setback is severe. In the presence of established trust, occasional behavioral lapses, such as emotional outbursts, can be forgiven, but severe violations of behavioral norms can set a relationship back to the testing phase or even dissolve it completely [Jones and George, 1998]. When a trustor' loses the motivation for a comprehensive analysis or their utilitarian needs cannot be fulfilled, the trustor may reduce the use of the forum and migrate to State 1. When a user/trustor's utilitarian needs are completely satisfied permanently (e.g., he/she is fully recovered) and, during the whole period of using the forum, the user/trustor fails to establish any strong group attachment or member attachment, the user/trustor may exit and cease visiting the forum. The opposite is observed where due to strong group attachment, terminal disease survivors still visit the forums after recovery to support other patients as a way of giving back to the community. Similarly, strong member attachment also can attract users for the purpose of socializing. However, if those friends migrate somewhere else, a user is likely to move as well. Thus, member attachment is less stable than group attachment.

VII. CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

This article contributes to our understanding of processes involving dispositional and situational trust. Dispositional trust explains the trusting tendency of an individual on a spectrum with two extremes: extremely trusting and extremely skeptical. Trusting individuals tend to be optimistic and to trust people until given a reason not to [Marsh, 1994]. For these people, trust is developed in a deductive way, and situational trust is the result of general trust minus situations where a trustor was let down. On the other hand, skeptical individuals tend to be pessimistic and question everything until given a reason to trust [Marsh, 1994]. For skeptics, trust is developed in an inductive way and situational trust is the result of each positive experience with a trustee. Our trust formation process framework is able to explain situational trust because the framework is built on a sample base that contains both trusting and skeptical individuals. It particularly takes into account cases where a trustor is able to trust a contributor's ability to give medical advice but not comfortable with disclosing private matters to that person.

Moreover, this theory is also applicable to online health communities that are a hybrid of both an online forum with social networking features. Although this theory is primarily developed based on online health forums, social networking elements, such as private messaging, personal profile, and friend lists, already exist in online health forums. As long as an online health community is discussion-driven, text-based, and relationship-oriented, the theory still has sufficient power to explain trust formation. Particularly, a social networking structure can encourage the progression to State 2 and State 3 by increasing social presence and deepening self-disclosure. Social presence can be enhanced by strengthening a feeling of affinity between users [Biocca, Harms, and Burgoon, 2003; Nardi, 2005], and self-disclosure can be elicited by increasing direct contact and virtual proximity [Rubin and Shenker, 2006].

There are, however, a number of important boundaries and limitations to our theory that must be acknowledged. First, the process model explicitly deals with trust, but says little about *distrust*, which is a separate concept. Distrust has different antecedents and effects to trust [Benamati, Serva, and Fuller, 2008; Levicki, McAllister, and Bies, 1998; Sitkin and Roth, 1993], but may also explain transitions between states. An important distinction between trust and distrust is that trust accumulates gradually, whereas complete distrust can occur instantly. We acknowledge that our framework does not explain sudden complete loss of trust and does not account for trust repair, trust reconstruction, or distrust formation.

Second, our model does not account for the effect of healthcare affordability. We speculate that the higher the cost of accessing the healthcare system, the more likely one is to rely on online health communities for self-diagnosis and self-treatment. In the absence of recommendations from a medical professional, those behaviors pose higher risks to forum users. The risks may motivate users to apply a comprehensive evaluation and stay in State 2.

Third, a medical condition may moderate trust formation. Among the interviewed participants, some clearly indicated that they did not need emotional support and were interested only in informational support. Conversely, emotional support may more likely be sought in conditions where patients experience frequent and repeated undesired symptoms such as pain, which can influence patients' perception of self [Pincus and Morley, 2001], self-efficacy, and controllability [Compan et al., 2010; Cooper, Collier, James, and Hawkey, 2010], and induced emotional reaction, even mental health condition [Verbunt, Pernot, and Smeets, 2008]. Moreover, patients who have high-impact conditions face a higher risk of adverse consequences if the advice followed is incorrect. Therefore, these patients may be more motivated to conduct a comprehensive evaluation in information and its contributor before any action.

Finally, it is possible that gender affects trust formation: there is evidence that men interacting in male-dominated OHFs (e.g., prostate cancer) are more likely to seek information, while women in female-dominated OHFs (e.g., breast cancer) tend to seek social and emotional support [Gary, Fitch, Davis, and Phillips, 1996, Mackenzie, Gekoski, and Know, 2006; Seale, Ziebland, and Charteris-Black, 2006]. This difference has been attributed to females having more active limbic structures (related to emotion and motivation) in the brain than males when evaluating trustworthiness [Riedl and Hubert, 2010]. However, these search patterns seem not to be apparent in mixed-sex OHFs [Mo, Malik, and Coulson, 2009], raising the question of whether it is biology or environment that is actually responsible. The framework reported here is developed using a sample of twelve females and four males from mixed-sex OHFs. The gender influence on the framework may not be significant, but it is still worth exploring whether different genders can progress in the framework differently. Future research could focus on moderation and tailor IT tools to suit different scenarios.

VIII. CONCLUSION

The aim of this article is to examine how trust is formed in a text-based relationship-oriented online community. The medical context was chosen as the focal interest of online communities due to its unparalleled characteristics. A qualitative interpretive approach was employed to enrich the understanding of trust formation in online health communities specifically. Consequently, a process framework of three-state trust formation emerged from the data. This framework makes an important novel theoretical contribution and illustrates that trust is developed and strengthened through states. Compared with existing trust theories, the process framework not only describes the constructs and their associations with each other as events in each state, but also articulates who/what are included, the changes in their attributes over time, and what necessary conditions facilitate the changes.

The process theory of trust is positioned as an answer to the research questions and a solution to the problem of information assessment in online health communities. The theory depicts three ways of obtaining credible information: information-oriented (State 1), trust-oriented (State 2), trustee-oriented (State 3) strategies. These three states suggest two different information-rendering strategies. An information-based approach, such as information aggregation, can purposely satisfy users' learning needs without browsing through threads and fragmented information. A people-based mechanism, based on the similarity between patients (e.g., www.patientslikeme.com), can meet both users' informational and emotional needs, and help users to identify and connect to trusted sources for credible and relevant supports. Both rendering strategies can substantially assist patients' self-empowerment within evidence-based healthcare practice.

Our research findings also lead us to the following practical recommendation about how to design online health communities to retain users. The process framework suggests that group attachment can be strengthened at all stages. Previous literature suggests ways of doing this—name of a community, logo, mission statement, information that signals the similarity between users (e.g., hot topics, frequent participated activities)—can be used to highlight the difference from other online health communities and/or between subgroups [Ren et al., 2012]. Second, cultivating member attachment requires a more social environment. Subgrouping and segmenting users [Tolmie and Boyle, 2000; Wegerif, 1998], maintaining off-topic discussion areas, creating personal profiles, applying identifiable

user names or avatars [Jones and Preece, 2006], and supporting private interaction [Fortin and Dholakia, 2005] could increase social presence and foster member attachment. Doing so, we believe, will alleviate information overload, increase relevancy, simplify information evaluation, and play a role in strengthening attachment to an online health community and its members.

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Editor's Note: The following reference list contains hyperlinks to World Wide Web pages. Readers who have the ability to access the Web directly from their word processor or are reading the article on the Web, can gain direct access to these linked references. Readers are warned, however, that:

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APPENDIX A: INTERVIEW QUESTIONS AND SAMPLE QUOTES

This appendix contains samples of interview questions used by the primary investigator when conducting interviews. It includes sixteen main questions and nine sub-questions (optional). In most cases, all main questions are covered roughly in this given order but the depth and detailing in responses vary. In some cases, due to the participants' role and experience, certain questions became irrelevant (e.g., One may seek information only and is not interested in emotional support; one may be a survivor who has no utilitarian needs and go to the forum only to help others.) and thus, were omitted in the interviews. In some other cases, new questions were added to explore specific areas of interest and elicit additional understandings as the study progressed.

The interview questions were developed based on previous studies to answer the research questions about *how trust is formed based in a text-based relationship-oriented online community*.

Table A–1: Interview Questions and Sample Quotes		
Interview questions*	Sample quotes	Results
How trustworthy do you find information and advice online in general? Do you consider yourself a trusting person? What drives you to start using this type of online service?	*Really good. It's true [I'm] not getting any help from medical profession and sending me to medical forums to start with* (p. 1, A14). *As for online information, I have caution in my mind. I'll look at them with a great degree of doubt* (p. 1, A7). *I personally experienced several cancers and I find particularly Forum A to be a convenient way for me to mentor the service to other people [who] are experiencing the emotional difficulties of cancers* (p. 1, A1).	In general, online health information is trustworthy but approached with caution. Some participants are trusting, while some are skeptical. Unsatisfied informational and emotional needs and the intention to give back drive the use of OHFs.
I notice that you go to Forum A repeatedly. What keeps you going back to that one?	*I meet some great friends on Forum A. Unfortunately they all died now, but there are other people that I read their stories and I'm interested in how they're going, even though I don't post as much as I used to* (p. 1, A3). *The diversity of conversation. I find this one [forum] I quite like so I don't bother to look for anything else* (p. 2, A15).	Both people met there and the forums self-attract repeated visits.
When you go on an online health forum, what type of information and/or support are you looking for? Do you particularly look for certain information to support or refute a pre-existing belief?	*Just for more details about the conditions and what else you can do to help it. So I guess I do look for factual information and experiential information. I'm more keen on scientific information* (p. 1, A9). *I weigh up both negative and positive comments. If I see something interesting, I always go check if the thing is good or not* (p. 3, A5)	Both informational and emotional support. See "confirmation bias" in the section of Process 2 under "Research Findings."

Table A–1: Interview Questions and Sample Quotes – Continued		
When you read a piece of message or story, what makes you believe that what the person tells is true? What indicators tell you that the information is trustworthy? What factors help you determine the quality of the information in a posting?	*He provides links and references. He must be a medical person I think because some of the stuff he wrote is more than a laymen person. The terminology, the word he used. He must have some medical training. I'll guess he must have done some medical research himself. It sounds a little bit too medical to me* (p. 5, A2). *They're particularly trustworthy because some of the postings are extremely well-written, seem like medical literature … put into the words that the rest of us can understand* (p. 1, A10). *It depends on what the information is about. If it is scientific information or medical information, a lot of them I think it's wrong because it's skewed and inaccurate according to what I know. With my knowledge, I don't really trust it 100% because I may not have the full picture* (p. 2, A6). *If they put some details, it sort of proves in a way that they're actually going through it because those things you learned as pensioner you won't know about if you are just a person on the street. So if they're talking about a particular chemo-therapy that they might have some experience with, and they're talking about some of the side-effects that I recognize, then I'll think you're genuine* (p. 6, A3).	A set of criteria was identified by participants as a way to assess information credibility. See "Perceived Information Credibility" in the section of Process 2 under "Research Findings."
When you browse other people's posts, do you pay much attention to who posted it? Do you place more weight on postings from people whom you are familiar with? Why?	*Sometimes it's really good that some people got little pictures and you don't need to remember their usernames but just remember their icons. Some people go on the forum regularly and you can tell they really put a lot of effort into it. And there [are] others who you just see once or twice* (p. 2, A4). *And if I recognize also people who write in, some of them have been associated with the forum for so many years and I recognize the quality of the information* (p. 4, A11).	See "Familiarity" in the section of Process 2 under "Research Findings."
What do you look for in others' experience? What is your impression of users who seem to have similar experiences as yourself? How do you react to their experiential story?	*I wanted to know what other people have coped with [during] the treatment I was having. I wanted advice on diet, how they cope mentally* (p. 2, A3). *Some of them I wouldn't have any more confidence in them just because they got the same thing as me, because I know that they're a bit lazy and just taking the easy way out* (p. 8, A12). *If you have the problem, after a few posts they post on, you tend to be drawn to the person who's got the similar to you than someone else…. You don't always believe people but you do tend to be drawn close to people that are similar as you got…. I would talk to both of them [who have contradictory opinions,] but I probably lean toward the similar one* (p. 4, A5).	See "Perceived Similarity" in the section of Process 2 under "Research Findings."

Table A–1: Interview Questions and Sample Quotes – Continued		
Have you ever noticed any instances where people share their feelings in the forum? Have you ever noticed any instances where people show empathy toward others? How do you evaluate the trustworthiness of a participant who suggests he/she knows how you or others feel (i.e., expresses empathy)?	*A lot of them when you read what they say, there is a level of compassion in there, which you think you're a decent human being* (p. 5, A3). *Sometimes I feel it's [a] little doggy that he wants to know what you or your friends got and I'm not looking for any emotional support as much as to find out what other people have done with their problems…. If compassion is too unnatural or want to be emotional connected too much. I don't like it that much* (p. 3, A9).	See "Perceived Empathy" in the section of Process 2 under "Research Findings."
Have you ever posted any personal experience in an online health forum? Yes.—Why did you decide to share personal experience? No.—What are the concerns you have about sharing personal experience in the online health community?	*I think there is always concern. Because only a portion of members post, and you tend to get people who just read it but not posting. So you don't know who they are and what the background … is. This community is very small. In Adelaide, I feel very identifiable. I feel bad that I'm not on the committee but I've served for journal and national body for years. So some people know me. I'm careful what I put up about family* (p. 7, A10). *It is an issue but I don't provide sensitive or privacy things* (p. 4, A8).	The privacy concern split. Some do have a concern, but some do not. A within-case analysis did not unveil any relationship between privacy concern and trust and trusting behaviors.
Besides contributing, have you ever followed anyone's advice on the forum? Yes.—Why did you decide to follow that advice? Yes.—What is your advice adoption strategy? (e.g., following advice that seems sensible to you and meets your needs regardless of others' opinion on it; looking at who has provided the advice, or looking for several occurrences of that advice?) No.—What are the reasons that prohibit your adoption behavior? Do you engage in any other activities in online health forums, such as forming friendship and recommending a post to others?	*It's lucky when the information source is reputable, and it's just one of those things that you read and think hmmm it makes sense* (p. 4, A16). *The guy who runs the forum now calls me mother…. I'm near Sydney and he's all the way down in the central area. Some people are from overseas and we make friends with [them] now. Call them sisters and yah you can get really close to them. It extends to offline if you get close to them. Three or four from the forum call me and visit me. After you get very close to someone online after talking long enough, you would trust them* (p. 8, A5). *Not on the forum. I have friends in real life and the forum is just an extra* (p. 9, A13).	See the section of Process 1, "Trust-related Behaviors" in the section of Process 2 and the section of Process 3 under "Research Findings."
*Though some questions specifically target research questions, responses to other questions have also provided valuable insights.		

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