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**Community Attachment and Emotional Wellbeing:
An Empirical Study of an Online Community for People with Diabetes**

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Abstract

The purpose of this research is to investigate how attachment to an online health community (OHC) may reduce the OHC users' emotional distress and therefore improve their emotional wellbeing. This is one of the first studies on the antecedents of community attachment and the relationship between community attachment and emotional distress in the context of OHC. A survey study was conducted in one of the largest online health communities for people with diabetes. We found that community attachment is positively associated with the OHC users' normative expectations of reciprocity and their affective feeling of gratitude. However, some commonly used behavioral metrics of community participation, such as visit frequency and membership tenure, have little to do with either community attachment or reduced emotional distress. The research highlights the pivotal role of community attachment in appraising the much-debated benefits of OHCs. The study also implies that design features facilitating reciprocation and gratitude expression among users can lead to a strong community bond.

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Introduction

Managing chronic diseases such as diabetes needs ongoing support from both healthcare professionals and patients' own social networks. While healthcare systems in many countries are struggling to provide a service to their aging populations (Haseltine, 2018), increasingly ubiquitous internet access seems to have opened the door to almost unlimited online social support (Sendra et al., 2019). Prior research has shown that online health communities (OHCs) formed through social networking sites, messenger apps, and bulletin board forums have the potential to supplement professional medical care in improving patients' wellbeing (Bernardi, 2016; Huang et al., 2019). Indeed, interacting with other people living with the same chronic condition has become an important component of health self-management and patient empowerment in many healthcare programs (Meng et al., 2019; Willis and Royne, 2016). In addition to providing access to valuable health information such as treatment and tips for the day-to-day management of their condition (Willis and Royne, 2016), mutual understanding and comfort shared in OHCs can promote **emotional wellbeing** by reducing community members' **emotional distress** – a sense of anxiety and helplessness of living with a chronic condition – and replacing it with an increased sense of security and relief (Huang et al., 2019; Turner and Kelly 2000). In particular, extant literature shows that OHCs play a significant role in reducing patients' emotional distress in terms of helping develop effective coping strategies (Kim et al., 2010; Namkoong et al., 2013; Yoo et al., 2014) and boosting confidence in the self-management of a chronic condition (Willis and Royne, 2016).

Yet academic studies also seem to suggest that the expected emotional benefits of OHC participation are not always achieved. On the contrary, OHCs can be detrimental to emotional wellbeing when online information and social interactions induce anxiety and distress (Batenburg and Das, 2015; Smaldone et al., 2020). For example, Smaldone et al. (2020) argue that health information obtained through social media could lead to a phenomenon called “cyberchondria” where people grow anxious about various diseases despite not having been

diagnosed. In light of these mixed evidences about the benefits of OHC participation, this study aims to investigate **the pivotal role of community attachment** in realizing the potential emotional benefits of OHC participation. Following Ren et al. (2012), we use community attachment in this study to refer to “members’ affective connection to and caring for an online community” (p. 842). The premise about the role of community attachment draws upon recent OHC studies in the IS discipline (e.g., Chen et al., 2019) and community psychology studies that demonstrate the therapeutic effects of community attachment in coping with emotional stress (Farrell et al., 2004; Kutek et al., 2011; Morelli et al., 2017).

Additionally, we draw upon organizational commitment research and social exchange theories to unpack important *antecedents to community attachment*. While organizational commitment theory (Meyer and Allen, 1991) and its applications in online community research (e.g., Bateman et al., 2011) emphasize the *behavioral* process by which individuals develop a positive attitude (or commitment) toward an organization or community, online community research that draws on social exchange theories points to the *norm of reciprocity* and *feeling of gratitude* as the cornerstones of affective relationships (Wasko et al., 2009; Wu and Korfiatis, 2013). Coupled with our critical appraisal of the social support and online community literature, we therefore propose to investigate community attachment along three dimensions: behavioral (level of participation), normative (reciprocity), and affective (gratitude).

This study aims to fill two important research gaps concerning the potential impact of OHCs on patients’ wellbeing. First, while a handful of studies have shown that OHC’s emotional benefits are contingent on a variety of factors such as personal characteristics (Yoo et al., 2014) and social comparison (Batenburg and Das, 2015), there is little research on the relationship between community attachment and emotional distress. Second, previous IS studies have treated community attachment (or similar constructs) as a priori psychological state in evaluating its effect on online communities (e.g., Bateman et al., 2011; Ren et al., 2012), but few researchers have investigated how one’s attachment to the online community takes form in the first place (Tonteri et al., 2011). We address these gaps by postulating and empirically testing that: 1) the level of OHC participation, the normative expectation of reciprocity, and the feeling of gratitude toward the community, strengthen one’s attachment to the OHC community; 2) such an attachment is associated with the patient’s reduced emotional distress (i.e., improved emotional wellbeing).

To test our hypotheses, we conducted empirical research in one of the largest OHCs for people with diabetes. The findings suggest that OHC participants are likely to experience reduced emotional distress when they have developed an attachment to the community. This attachment is, in turn, positively associated with the normative expectations of reciprocity and the affective feeling of gratitude. However, some commonly used behavioral measures of community participation, such as visit frequency and membership tenure, have little to do with either community attachment or reduced emotional distress. Instead, we find that the amount of time OHC users spend on the site may be a more reliable predictor of their community attachment, and the number of posted messages is, surprisingly, associated with increased emotional distress.

The remainder of this paper is organized as follows: we first review relevant literature to identify gaps and provide motivations for this research, before formulating a set of hypotheses for our empirical study. We then describe the context of data collection and present the data analysis results. We discuss the results in relation to hypothesis testing and explain both theoretical and practical implications of the findings. We conclude the paper by reflecting on limitations of the present study and potential venues of future research.

Emotional Wellbeing and Social Support in OHCs

In OHCs, information sharing and conversations among participants provide different types of social support. OHC participants receive informational support from the abundance of information about treatment and the day-to-day management of a medical condition (Johnston et al., 2013). At the same time, they find emotional relief in each other's stories about the difficulties and frustrations of living with their condition (Merolli et al., 2013; Yan and Tan, 2014). While both types of social support – informational and emotional – empower patients in gaining better control of a chronic condition (van Berkel et al., 2015), a literature review on social support in OHCs by Allen et al. (2016) suggests that emotional support exceeds informational support to be the main benefit of OHC participation. This is not surprising given that the sense of exhaustion, anxiety, and helplessness as a result of a long-term condition are particularly detrimental to the wellbeing of patients (Welbourne et al., 2013).

People who suffer from a chronic condition can also reach out to their offline network of friends and family for social support. While offline and online social support are similar in some

respects, e.g., both providing patients with greater confidence in health self-management, OHCs are particularly suitable for emotional support thanks to the *anonymity* and *asynchronicity* of online communication. With anonymous communication, people often find it easier to share illness experiences online with strangers than with their offline contacts (Joinson, 2001; Allen et al., 2016). *Anonymity* in OHCs reduces people's fear of disclosing their experiential details and provides a safe environment where people validate one another's feelings (Wohn and Lampe, 2018). This is particularly true for people who feel more vulnerable about having face-to-face discussions about their health, due to the stigma attached to a medical condition, such as cancer or diabetes (Frost et al., 2014).

Asynchronicity of communication is another advantage of OHCs in terms of providing both informational and emotional support (Wright and Bell, 2003). Asynchronous communication in OHCs typically occurs when a user posts messages to a discussion forum and others respond at various times. This means a great amount of information is archived and is always available to those in need of support. More importantly, asynchronicity allows the message poster to carefully think about and edit their message before posting, which encourages a high level of self-expression and self-disclosure (Walther, 2007). By revealing more about themselves to a large audience through anonymous and asynchronous communication, members of OHCs benefit from greater empathy and solidarity than in offline support networks (Barak et al., 2008).

Past research on social support in OHCs shows that OHC participants benefit from the online support in different ways, depending on their personal and sociopsychological characteristics, such as their capability of expressing and eliciting social support (Yoo et al., 2014), the status of their mental health (Yan and Tan, 2014), and their social comparison strategies (Batenburg and Das, 2015), yet a direct positive relationship between the level of OHC participation and wellbeing might not always hold, and the link between online participation and emotional wellbeing remains unclear (Batenburg and Das, 2015). For example, Oh et al. (2014) found that the size of a social network site and the intensity of use did not predict supportive interactions associated with improved subjective wellbeing, stressing the importance of the quality of interactions to achieve the emotional benefits of online support. In line with this proposition, other studies examined the link between improved emotional wellbeing and the establishment of *meaningful social and affective relationships* in OHCs. For example, Erfani et al. (2017) found that social connectedness and social presence through visible acts of online

communication had a positive impact on the emotional wellbeing of cancer patients in a Facebook group. Similarly, Welbourne et al. (2013) found a significant relationship with reduced stress for social connectedness but not for a sense of community, thus contradicting recent, albeit limited, research examining the positive effect of a sense of community on OHC participants' emotional wellbeing (e.g., Obst and Stafurik, 2010). Altogether, these studies seem to point to the need for more research on the development and emotional benefits of affective connections in OHCs.

Community Attachment and Its Antecedents

Attachment responds to people's basic need to form affective connections with their social group or community. Drawing on theories of social identity and organizational commitment, online community researchers have conceptualized such attachment to online communities as a sense of virtual community (Blanchard and Markus, 2004), affective community commitment (Bateman et al., 2011), affective social identity (Tsai and Bagozzi, 2014), and emotional identification (Chiu et al., 2006). Although there are subtle conceptual differences among these terms, a shared premise in these studies is that an emotionally fulfilling bond with the online community is beneficial to individual community members and the community as a whole.

While much has been written about the role of community attachment in sustaining online community members' interactions and engagement (Fan and Lederman, 2018; Panteli and Sivunen, 2019; Ray et al., 2014), fewer studies have sought to understand what gives rise to the attachment in the first place. Our conceptualization of the antecedents to community attachment draws inspiration from organizational commitment research and social exchange theories and their application in online community research. In theorizing employees' commitment toward an organization, Meyer and Allen (1991) distinguish between "commitment as a psychological state and commitment as behavioral persistence" (p. 78). While acknowledging "a feedback chain", they emphasize the behavioral, normative, and affective processes by which individuals become locked into a certain organization, which then contribute to the development of a positive attitude (commitment) toward the organization.

While Meyer and Allen's (1991) analysis of behavioral, normative, and affective elements in organizational commitment helps frame our thinking, their model does not fit the OHC context. Unlike the contractual, economic exchange (i.e., labor for wage) between an employee

and their organization, the relationship between an online community participant and the community is **generalized social exchange** (Wasko et al., 2009; Wu and Korfiatis, 2013). In generalized exchange, the expected mutual and equitable relationship is between an individual and the generalized social unit as a whole, in the sense that resource exchange is not contingent upon the immediate and direct action of two individual actors in the social network. Rather, each actor in the social network is expected to provide a resource at some time to someone and eventually receive some reward in return (Ekeh, 1974; Takahashi, 2000). In order to sustain such indirect reciprocation, early social exchange theorists focused on *the norm of reciprocity*, or sense of mutual indebtedness (Greenberg, 1980), in building trusting, communal, and sustainable relationships in a social group (Molm et al., 2007; Uehara, 1990). Later work on social exchange, however, turns to positive psychology to disassociate the normative expectation (reciprocity) from the positive feeling (gratitude) of receiving help in generalized exchange (Watkins et al., 2006). Moody (2008) argues that indirect reciprocation comes from a purely internal “psychic imperative” of gratitude (p. 145), and this affective mechanism of gratitude can “inhibit short-term motivations for selfish resource acquisition by fostering decisions and actions centered on communal benefit” (DeSteno et al., 2010, p. 293). Thus, according to social exchange theories, the reciprocity *norm* (a beneficiary should give back) and the gratitude *affect* (a grateful individual is happy to help) both contribute to a sustainable, generalized interpersonal association (Blau, 1994).

In consideration of the above, our careful review of the online community and social support literature identifies factors conducive of close affective relationships along three dimensions of online community participation: behavioral, normative, and affective. These factors include participatory behaviors such as level of participation (*behavioral*), and sociopsychological mechanisms in generalized exchange, such as the social norm of reciprocity (*normative*) and the feeling of gratitude (*affective*).

Behavioral: Level of Participation

In the context of OHCs, participatory behaviors have been understood mainly as consuming and contributing content in an online space, which then results in behavioral patterns and individual perception of social support (Oh et al., 2014; Yang et al., 2017). Some participants are “discussion persons” or “answer people” (Welser et al., 2007) who actively post

or reply messages, but many others visit an online community to consume content passively without engaging in contribution (Preece et al., 2004). In fact, by observing four OHCs, Mierlo (2014) confirmed the so-called “1% rule” of content contribution in these communities; that is, 90% of users observe and do not contribute content (“lurkers”), 9% contribute sparingly, and only 1% create the vast majority of new content.

Past studies of online communities show mixed or even contradictory findings about the relationship between participation and community attachment (or a similar construct). While Bateman et al. (2011) showed a positive association between affective community commitment and posting behavior, Lee and Park (2019) did not find a significant relationship between the amount of content posted and community attachment. Similarly, Welbourne et al. (2013) showed that posting support was not associated with a sense of community among two OHC participants. On the other hand, Tonteri et al.’s (2011) study of participatory behaviors in an online newspaper discussion forum found that posting and reading messages both correlated with a sense of virtual community. Likewise, Yang et al. (2017) concluded that “lurkers” and “posters” did not differ in terms of the hypothesized effect of perceived community support on community commitment.

These previous findings demonstrate that simply looking at differences between posting and reading, or posters and lurkers, can be elusive and might not provide a satisfactory explanation of how participatory behaviors may be associated with an affective attachment to the online community. Some posters may take a purely utilitarian attitude, visiting the online community site just for the time necessary to obtain the information they require without feeling the need to form any affective connection (van Berkel et al., 2015). By contrast, some lurkers may visit the online community often and spend much time reading posts, thus forming an affective connection with the site without even posting a single message (Johnston et al., 2013). Thus, in investigating the relationship between community participation and community attachment, it is important to consider more nuanced measurements of the level of participation.

Level of participation may be assessed by *behavioral intensity indicators* such as site visit frequency, time on site, and total amount of postings. Each of these indicators may be associated with community attachment differently in different online settings. For example, Leimeister et al. (2008) found that posting, but not time on site, had a significant association with virtual social relationships, possibly because the formation of virtual relationships requires member-to-member active interactions. In a field experiment of an online movie-related community, Ren et

al. (2012) observed a positive association between an increase in post views and visit frequency and strengthened community attachment, but they did not consider posting behaviors due to a lack of empirical data.

In addition to intensity of participation, another behavioral indicator of level of participation is *membership tenure*. Like intensity of participation, membership tenure can also be associated with community attachment. For example, Yan and Tan (2014) used the duration of membership as a measure of commitment and found that OHC members with longer tenure tended to contribute more to the community than new members. Both Yang et al. (2017) and Lee and Park (2019) also treated membership tenure as a moderator that influences community attachment. Yet, in Ren et al.'s (2012) experiments, manipulated community features that were effective in driving up site visits and post views had no effect on improving membership retention, indicating that the latter might be a factor independent of participatory activities.

In summary, the online community literature shows that evidence on the relationship between different indicators of level of participation and community attachment is either limited or inconclusive.

Normative: Norm of Reciprocity

In social exchange theories, the norm of reciprocity refers to a sense of indebtedness that obliges the return of favorable or positive treatment (Gouldner, 1960; Greenberg, 1980). While reciprocity may drive direct exchange of benefits between two parties (“You scratch my back, and I’ll scratch yours”), social exchange theorists are more interested in generalized exchange where an individual beneficiary is expected to repay a favor at an undefined time in the future to anyone in the same social network. Such a normative expectation of indirect reciprocation is fundamental for mutual trust and community solidarity (Molm et al., 2007).

Healthcare literature has shown that reciprocity plays an important role in family care and social support. Patients in more reciprocal relationships are less likely to be depressed (Wolff and Agree, 2004) and have higher self-care confidence than their counterparts (Sebern and Riegel, 2009). However, the healthcare researchers focused on dyadic, offline relationships between a patient and their caregiver (usually a family member), whereas the generalized exchange between an individual and their non-familial, large social groups is uncommon in offline healthcare support. By contrast, reoccurring social exchange within a dyad in online

communities is rare; therefore, the norm of reciprocity in the online community literature usually refers to the expectation of a mutually beneficial relationship between community participants and the online community as a collective whole (Wu and Korfiatis, 2013).

To this end, IS researchers tend to emphasize mutuality and equity in online knowledge exchange scenarios, and often consider the norm of reciprocity in conjunction with other concepts such as trust and social capital. From early studies such as Ridings et al. (2002) and Bock et al. (2005), IS researchers have posited that an online community participant's contribution is partly driven by anticipated reciprocal benefits; conformity to the norm of reciprocity is critical in building trust among community members. Welbourne et al.'s (2013) study on two OHCs revealed that providing support had a positive association with sense of community only when it led to receiving support. They argue that the perception of unreciprocated support may lead to an increased sense of isolation and poor emotional wellbeing. While recent literature continues to show that reciprocity plays an important role in influencing individual- and community-level behaviors in various online communities (Chen et al., 2019; Pai and Tsai 2016; Yang et al., 2017), how the norm of reciprocity relates to the sense of community attachment remains unclear.

Affective: Feeling of Gratitude

Unlike participatory behaviors and reciprocity, gratitude as a positive affect has received very little attention in online community research, despite the fact that gratitude expression is a major category of postings in various online forums (Armstrong et al., 2011; Makri and Turner 2020; van Berkel et al., 2015). When gratitude is mentioned in some IS studies, it is either viewed as an intangible reward for contribution (Ridings et al., 2006; Yang et al., 2017) or mingled with the innate need to reciprocate the received help (Pai and Tsai, 2016). In the healthcare literature, gratitude, like reciprocity, is largely discussed in the context of dyadic offline relationships, such as those between patients and nurses (Converso et al., 2015) or the elderly and their familial caregivers (Lau and Cheng, 2017); hence, the focus tends to be on the positive effects of gratitude on the two parties directly involved in the care relationship.

A growing body of psychology literature supports the idea that gratitude is an important interpersonal affect in social interactions (Algoe, 2012; Ma et al., 2017; Watkins et al., 2006). In two longitudinal studies, Wood et al. (2008) tested six structural models to determine the

direction of the relationships between gratitude and other variables, including perceived social support, stress, and depression. Their results consistently demonstrate that gratitude is associated with higher levels of perceived social support, therefore confirming a basic premise in positive psychology that gratitude helps improve social functioning in social groups and communities (Fredrickson, 2004; McCullough et al., 2002).

Reciprocity and gratitude are naturally correlated as they stem from the same social event of helping; hence, it is not surprising to see that these two sociopsychological factors are being lumped together in online community literature. For example, in a qualitative study of a diabetes discussion forum, Armstrong et al. (2011) observed that the forum participants repeatedly emphasized the reciprocity of mutual help by expressing their gratitude and demonstrating their own contribution in assisting others. They referred to the “rhetoric of gratitude” as an important mechanism of fostering social support and a sense of togetherness: “We’re not on our own” (p. 354). In a more recent study of three luxury product discussion forums, Kao et al. (2020) equate reciprocity with “gratitude behavior” in their model about community commitment velocity. However, social exchange theorists have argued that gratitude is a distinctively positive affect different from the normative sense of indebtedness in reciprocity (Peng et al., 2018; Watkins et al., 2006). As Peng et al. (2018) effectively put it, gratitude concerns relational value and drives “proximity seeking” so as to build up social bond, whereas reciprocity is mainly about the normative indebtedness after receiving favors.

Taken together, we find that the behavioral, normative, and affective antecedents of community attachment remain underexplored in the OHC literature and the IS literature in general. In the section below, we further define and then hypothesize how level of participation, norm of reciprocity, and feeling of gratitude are associated with the formation of community attachment.

Hypotheses and Research Model

Community Attachment and Emotional Distress

Research by health psychologists has found that security attachment – namely individuals’ perceived security about their relationship with others – associates with better mental health and lower stress (Mikulincer and Shaver, 2007; Young et al., 2004). Similarly, research on social support and healthcare in community and health psychology has also shown that a sense of

community helps individuals better cope with stress (Kutek et al., 2011) and improves psychological wellbeing (Plys and Qualls, 2019). The emotional benefits of affective connections with a community also find confirmation in the online community literature, where research has shown that online community users with a higher level of community attachment perceive stronger empathy from other members (Zhao et al., 2013), which then helps them reduce stress (Morelli et al., 2017). Kaye et al. (2017) found that strong ties with online community members led to positive sociopsychological outcomes such as reduced loneliness. Fan and Lederman (2018) suggest that attachment can lead to deeper levels of trust and more enduring and stable relationships. Thus, through a stronger sense of attachment to an OHC, community participants are more willing to accept risk and have a higher confidence in experimenting with health-related advice shared online. This, in turn, helps patients self-manage their health and cope with the emotional distress of living with a chronic condition. Hence, we hypothesize that:

H1: Community attachment is negatively associated with the OHC participant's emotional distress.

Participatory Behavior and Community Attachment

Participation in OHCs typically involves visiting the site, spending time browsing the content, and posting new content. Through *posting*, OHC participants reveal more about themselves and their lived experience with a chronic condition, which then results in a greater sense of closeness with the community (Bernardi, 2016). In general, posting is strongly related to active social interactions within an online community: the more one posts, the more actively engaged they are with an online community, which then results in an enhanced sense of community attachment (Tonteri et al., 2011; Yang et al., 2017). Prior research on online communities also suggests that community attachment develops through *frequent visits* over time (Ren et al., 2012; Rotman and Wu, 2014). In addition, Whon and Lampe (2018) found that new members develop a sense of community by *spending time* on the community site to familiarize themselves with the content and norms of the community. *Membership tenure* or duration is another indicator of participation in an OHC. Previous research suggests that people who have been members of an online community for a long period are more likely to feel attached and committed to their community (Ren et al., 2012; Yan and Tan, 2014). This suggests that length

of membership might also be an important factor that contributes to the development of community attachment in an OHC.

In sum, these studies suggest that, in addition to the active participatory behavior of posting, other behavioral indicators such as visit frequency, time on site, and membership tenure may contribute to the development of community attachment. Therefore, we hypothesize that:

H2: Level of OHC participation is positively associated with community attachment.

H2a: An OHC participant's *number of postings* in the community is positively associated with their community attachment.

H2b: An OHC participant's *frequency of visit* to the community is positively associated with their community attachment.

H2c: An OHC participant's *time on site* is positively associated with their community attachment.

H2d: An OHC participant's *membership tenure* is positively associated with their community attachment.

Reciprocity and Community Attachment

A close examination of the IS literature suggests that the sociopsychological consequence of conforming to the norm of reciprocity has been underexplored. A handful of studies have explored indirect influences of reciprocity in developing an affective relationship with a community. For example, Sánchez-Franco and Roldán (2015) argued that the expectation of other people adhering to the norm of reciprocity motivated community participants to provide support, which then increased their sense of community. Yang et al. (2017) examined reciprocity as a moderator that affects the relationship between communication support and community commitment among lurkers and posters. Research on OHCs also indicates that by sustaining equitable exchanges in a healthcare community, reciprocity increases a sense of virtual presence, which then reinforces a sense of attachment to the community (Goonawardene and Tan, 2014).

Overall, there has been limited research on the direct relationship between reciprocity and community attachment in online community settings. This is surprising given that social exchange scholarship has long praised reciprocity for its role in stabilizing social commitment and building solidarity in a community (Molm et al., 2007; Yamagishi and Cook, 1993). In a generalized social exchange such as that in OHCs, the expectation and adherence to the norm of

reciprocity strengthen the affective bond among members in a social group (Cook and Emerson, 1978); hence, we investigate the direct relationship between reciprocity and community attachment by hypothesizing:

H3: The norm of reciprocity in OHCs is positively associated with community attachment.

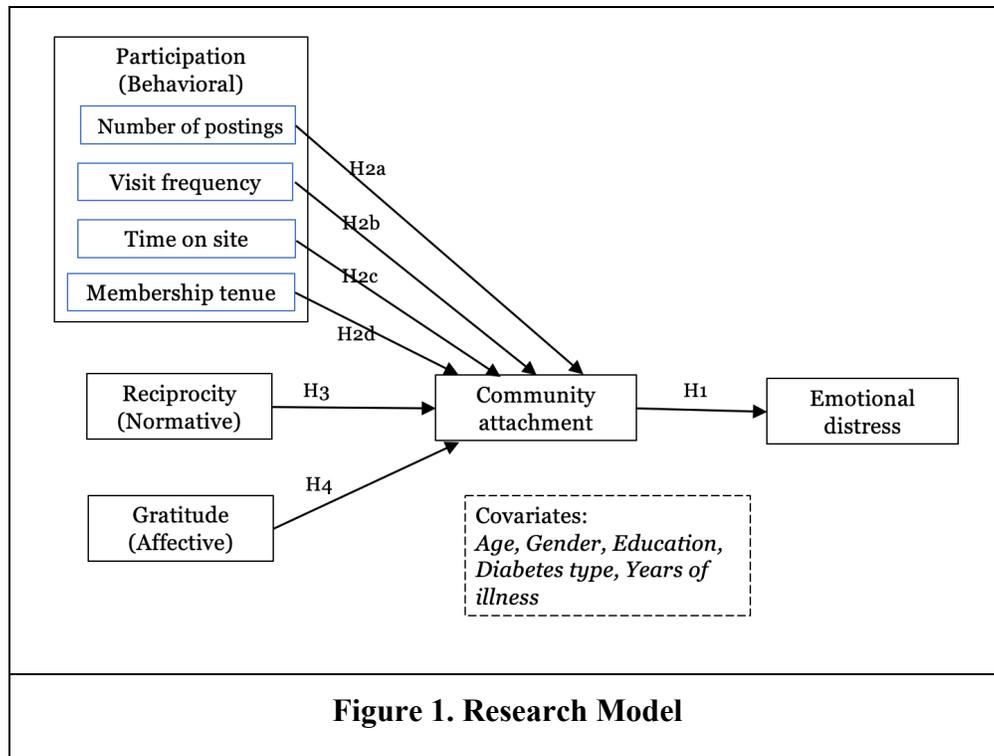
Gratitude and Community Attachment

In online community settings, gratitude is frequently expressed by the beneficiary toward the benefactor and/or the community as a whole. Online community researchers argue that experiencing gratitude and expressing it publicly helps sustain social support among the community participants (e.g., Makri and Turner, 2020). Psychologists have offered several explanations to prosocial effects of gratitude. Fredrickson's (2004) broaden-and-build theory posits that gratitude as a positive affect broadens the beneficiary's "thought-action repertoires" (i.e., habitual modes of thinking and action), from narrow tit-for-tat acts to a range of prosocial behaviors. According to the theory, as grateful individuals extend their appreciation to people other than the original benefactor, the actions build and strengthen social bonds. From the benefactor's angle, Grant and Gino (2010) propose that benefactors feel socially valued when they are thanked for their efforts, which motivates them to continue engaging in prosocial behavior. In a more recent essay, Fehr et al. (2017) argue that an individual's gratitude may converge to a "collective gratitude" at the group level through emotional contagion and social learning. This collective sentiment of gratitude constitutes the sense of attachment to the social group.

No matter what sociopsychological mechanisms are behind the effects of gratitude, it is evident that gratitude may act as "a kind of all-purpose moral cement" (Gouldner, 1960, p. 175) that binds people to one another and forms the basis for trusting and enduring social relationships. We expect to see such social bonding in OHCs where members often thank one another for providing informational and emotional support (Armstrong et al., 2011; Coursaris and Liu, 2009). We hypothesize:

H4: OHC participants' feelings of gratitude are positively associated with their community attachment.

In addition to the main constructs of interest, we consider a range of covariates that might influence the model testing results. In the context of the empirical study (detailed in the next section), we include in our model demographic characteristics (age, gender, education) as well as health-related variables such as years of illness and diabetes type. Our research model and hypotheses are illustrated in Figure 1 below.



Empirical Study

Participants and Data Collection

We conducted our empirical study in collaboration with diabetes.co.uk (DCUK). Active since 2007, DCUK is the largest community of people with diabetes (PwD) in Europe, with over 600,000 registered users at the time of writing. The site hosts a number of discussion forums, on which over two million posts have been generated by its users. Each of the forums focuses on a particular topic area; some of the most popular forums in terms of posting volume include “Newly Diagnosed”, “Greetings and Introductions”, “Type 1 Diabetes”, and “Type 2 Diabetes”.

Social interactions on DCUK mainly occur in discussion threads. While anyone can browse the forums and read the posts, only a registered user can create a post, “like” a post, or send private messages to other registered users. When registering for a DCUK user account, one only needs to provide a valid email address, a “preferred username”, and a password. No personally identifiable information is required, which makes the participation in the community anonymous by default. The forum discussions are moderated by volunteers who are usually “expert patients” (Fox et al., 2005) and long-time forum users. Although DCUK has an advisory board that consists of medical professionals, they do not participate in the day-to-day forum management or discussions.

The community’s senior management team were actively involved in designing and deploying the empirical study. Two senior executives reviewed the survey questionnaire and made suggestions to improve factual accuracy and appropriateness of wording in some of the questions. The researchers also worked closely with the management team to determine when and how to distribute the survey invitations. However, it is worth noting that the researchers remained independent throughout the process, and no compromise was made in the research design as a result of the collaboration with the community managers.

We initially planned to recruit a small number of community participants in a pilot study to assess the psychometric properties of the survey instrument, as well as to solicit qualitative feedback on the questionnaire design. Due to an administrative error, the pilot study invitation emails were distributed to a wider audience than initially intended, which resulted in over 1,000 responses to the pilot survey. We used this data set to reduce the dimensionality of the scale, to assess the scale’s psychometric properties, and to finalize the instrument for the main study. We then asked DCUK managers to send another survey invitation to a random sample of registered community users who had not participated in the pilot study.

From November 2017 to April 2018, three waves of email invitations and reminders were sent to 1,500 DCUK users who were not part of the pilot study, and we received 905 responses in total (response rate 60.3%). We carefully screened the data and removed dubious responses (e.g., responses with a less than 300-second completion time, responses which skipped more than 50% of the main factor items, and responses with a “0” answer to the membership tenure question). We also removed outliers where answers seemed unrealistic. For example, in one outlier case the respondent indicated that they had been a member of the community for 164 months, while the

site had only existed for approximately 130 months at the time of the survey. The final dataset for analysis contained 457 observations (N=457). The demographics of the respondents and other descriptive statistics in our sample are shown in Table 1.

Table 1. Sample Demographics and Descriptive Statistics

Variable	Category	Frequency				
Age	18-24	11 (2.4%)				
	25-34	13 (2.8%)				
	35-44	31 (6.8%)				
	45-54	93 (20.4 %)				
	55-64	162 (35.4%)				
	65 or older	128 (26.9 %)				
Gender	Male	204 (44.6%)				
	Female	230 (50.3%)				
	Prefer not to say	5 (1.1%)				
Diabetes type	Type 1	134 (29.3%)				
	Type 2	299 (65.4%)				
	Other	22 (4.8%)				
Education	Secondary Education	70 (15.3%)				
	Post-Secondary Education	46 (10.1%)				
	Vocational Qualification	92 (20.1%)				
	Bachelor's Degree	122 (26.7%)				
	Master's Degree	54 (11.8%)				
	Professional Degree	25 (5.5%)				
	Doctorate	26 (5.7%)				
Frequency of visiting DCUK in the last three months	Not once	24 (5.3%)				
	Once or twice in the last three months	78 (17.1%)				
	Once or twice a month	80 (17.5%)				
	Once or twice a week	94 (20.6%)				
	Several times a week	44 (9.6%)				
	Once or twice a day	55 (12.0%)				
	Several times a day	82 (17.9%)				
		Mean	Median	Mode	SD	Min
Years of having diabetes	13.43	7	2	15.28	0	68
DCUK membership tenure (in months)	28.69	24	24	24.28	2	120
Time (in minutes) spent on DCUK in a typical week	78.56	30	60	169.19	0	1800
Number of postings on DCUK	452.29	7	0	1602.53	0	16196

Measurements and Scale Validation

Through reviewing a large base of IS, psychology, and healthcare literature, we identified previously validated survey items to measure the constructs in the research model. To measure the *level of participation*, we collected data on frequency of visiting the site, time spent on the site, DCUK membership tenure, and number of postings on the forums (Batenburg and Das, 2015). We asked respondents to report the following: how frequently they had visited diabetes.co.uk forums in the previous three months (“Not once”, “Once or twice a month”, “Once or twice a week”, “Several times a week”, “Once or twice a day”, “Several times a day”); approximately how many minutes they spent on the forums in a typical week; how long (in months) they had been a member of the DCUK community; and, according to their DCUK personal profile, the total number of messages they had posted.

We examined several *reciprocity* scales in the online community literature and developed four items based on Kankanhalli et al. (2005) and Wasko and Faraj (2005). We measured *gratitude* with three items adapted from Bartlett and DeSteno (2006) and DeSteno et al. (2010), which asked “how grateful/appreciative/positive” a person feels toward those who have helped them on the OHC forum. Measures for *community attachment* were drawn from Bateman et al.’s (2011) study of “community commitment” and Chiu et al.’s (2006) scale of “emotional identification” with a virtual community. Instead of asking generic questions about *emotional distress*, we chose to adapt five items from Polonsky et al.’s (2005) Diabetes Distress Scale, a widely used scale in medical literature for evaluating patients’ emotional burden (e.g., sense of anxiety and distress) of living with diabetes (e.g., “I feel angry, scared, and/or depressed when I think about living with diabetes”). It is worth noting that, whenever possible, we chose to use diabetes-specific scales in the healthcare literature rather than more generic items in the IS literature to ensure the measurement validity in this empirical context.

A preliminary version of the survey instrument was reviewed by the founder and a senior researcher of DCUK to ensure its content validity. We then examined the instrument’s dimensionality by performing a principal component analysis (PCA) in *R* on the pilot data set. All item loadings were higher than 0.6, and all exceeded cross-loadings. Following the PCA analysis, we conducted a confirmatory factor analysis (CFA) in *R* to assess the measurements’

psychometric properties. The analysis produced a Chi-square of 912.758 (versus a baseline model with $\chi^2 = 17945.653$), a CFI and a TLI of 0.965 each, an RMSEA of 0.071, and an SRMR of 0.052. These indices indicate a reasonably good fit to the data, especially considering our large pilot sample size (Hoelter, 1983). In addition, the z-value for each loading estimate is also significant ($p < .001$). We then finalized the questionnaire and hosted the survey on Qualtrics for our main data collection.

Data Analysis and Results

Measurements Model Evaluation

With the 457 usable observations collected in the main study, we further assessed reliability and validity of the survey instrument. We built a measurement model using ADANCO 2.1 (Henseler et al., 2018) and conducted a CFA to evaluate the scale’s convergent validity, discriminant validity, and reliability. Upon examining the measurement items’ factor loadings and cross-loadings on each construct, we dropped one item from the “reciprocity” scale due to its high cross-loadings (> 0.5) on a construct other than the corresponding main construct. All other items loaded much higher in their main factor than in other factors, with no cross-loadings above 0.5. Reliability of instrumentation was assessed by two criteria: Cronbach’s alpha and composite reliability (CR). In our case, the alpha values range from 0.826 to 0.972, and CR from 0.896 to 0.982, both indicating excellent reliability. The average variances extracted (AVEs) for the latent constructs, ranging from 0.742 to 0.946, show good convergent validity of the measurement model (Table 2). At the same time, the square root of AVEs are greater than the inter-construct correlations, showing good discriminant validity (Table 3).

Table 2. Measurement Item Loadings and Scale Quality

	GRA	REC	CA	ED	<i>Cronbach's α</i>	<i>Composite Reliability</i>	<i>AVE</i>
GRA1	0.956	0.293	0.355	-0.080	0.972	0.982	0.946
GRA2	0.983	0.292	0.334	-0.090			
GRA3	0.980	0.283	0.330	-0.057			
REC1	0.076	0.817	0.347	0.042	0.826	0.896	0.742
REC2	0.188	0.883	0.435	-0.010			
REC3	0.240	0.883	0.480	-0.034			

CA1	0.338	0.458	0.906	-0.006	0.950	0.960	0.800
CA2	0.370	0.479	0.939	-0.012			
CA3	0.380	0.493	0.928	-0.054			
CA4	0.272	0.459	0.873	0.025			
CA5	0.245	0.449	0.873	0.046			
CA6	0.273	0.436	0.845	0.059			
ED1	-0.032	-0.019	0.020	0.852	0.939	0.953	0.803
ED2	-0.021	0.025	0.056	0.931			
ED3	-0.075	-0.036	0.011	0.899			
ED4	-0.109	-0.045	-0.056	0.941			
ED5	-0.103	-0.050	0.003	0.855			

Note: GRA: Gratitude; REC: Reciprocity; CA: Community Attachment; ED: Emotional Distress

Table 3: Inter-Construct Correlations with Square Root of AVE in the Diagonal

	NP	VF	TS	MT	REC	GRA	CA	ED	AGE	GEN	EDU	DT	YI
NP	1.000												
VF	0.319***	1.000											
TS	0.364***	0.453***	1.000										
MT	0.013	-0.007	0.092	1.000									
REC	0.228***	0.087	0.301***	0.082	0.861								
GRA	0.390***	0.226***	0.373***	-0.050	0.467***	0.973							
CA	0.194***	0.173**	0.464***	0.066	0.548***	0.546***	0.894						
ED	0.305***	0.175**	0.128**	-0.049	0.047	0.082	-0.101*	0.896					
AGE	0.104*	0.025	0.023	0.091	0.008	0.032	0.056	0.278***	1.000				
GEN	0.099	0.055	0.084	0.061	0.082	0.095	0.009	0.064	0.289***	1.000			
EDU	0.052	0.134**	0.003	0.118*	0.177**	0.003	0.071	0.033	0.024	0.088	1.000		
DT	0.046	0.020	0.062	0.075	0.076	0.021	0.037	0.140**	0.265***	0.252***	0.097	1.000	
YI	0.019	0.019	0.057	0.167**	0.122**	0.152**	0.018	0.029	0.037	0.098	0.020	0.390***	1.000

Note: NP: Number of Postings; VF: Visit Frequency; TS: Time on Site; MT: Membership Tenure; REC: Reciprocity; GRA: Gratitude; CA: Community Attachment; ED: Emotional Distress; GEN: Gender; EDU: Education; DT: Diabetes Type; YI: Years of Illness

As all measures are collected in the same survey, there is the possibility of common method bias (CMB). We adopted several procedures to control and diagnose potential CMB. First, we used the online survey software to randomize the order of the measurements, so that the responses were less likely to be influenced by the position of the items in the questionnaire (Podsakoff et al., 2003). Then, we followed Craighead et al.'s (2011) suggestion to use a CFA

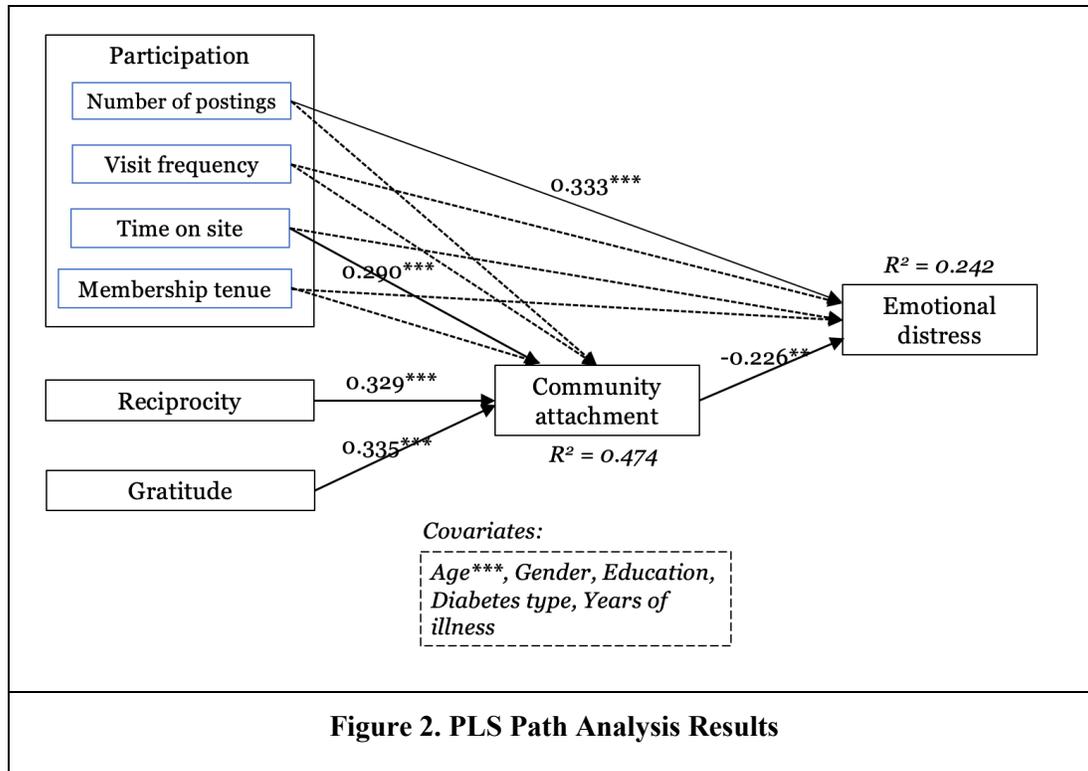
approach in Harman's single-factor test to assess common method variance. If the covariance among measures is mainly due to CMB, a one-factor CFA model would fit better than the measurement model. In this case, the one-factor model ($X^2 = 6748.35$, CFI = 0.38) yielded a poor fit compared to the actual measurement model ($X^2 = 527.64$, CFI = 0.96). Finally, we used the marker variable technique to diagnose potential CMB in the structural model (Rönkkö and Ylitalo, 2011). After examining the correlations of all the items in the survey, we chose "knowledge of diabetes" as the marker variable as it had low correlations with variables tested in the model. Next, we ran the PLS structural model first without the marker (the baseline model) and then added the marker in the model as an exogenous construct. All path significances remained unchanged after including the marker variable in the model. Taking these results together, we conclude that there is little evidence of CMB posing a serious threat to our analysis and interpretation of the data.

Structural Model Evaluation

We then proceeded to assess the structural paths in the research model with all latent variables modeled as being reflective. As the survey data of "time on site" (in minutes) and "number of postings" were highly skewed (see Table 1), we added a constant (1) to all observations and then log-transformed the data. We then tested the hypotheses by examining the sign and significance of the path coefficients. A bootstrapping technique was applied to estimate the significance of the path coefficients. The hypothesis testing results are summarized in Figure 2 and Table 4.

In addition, as the construct "Community attachment" in our model serves as a potential mediator, we examined the mediating effect following Baron and Kenny's (1986) procedure, which was more recently articulated by Zhao et al. (2010). We first assessed direct effects of the antecedents ("Participation", "Reciprocity", "Gratitude") on the endogenous construct "Emotional distress". None of the path coefficients were significant except for the "Number of postings \rightarrow Emotional distress" ($\beta = 0.333$, $p < 0.001$). Adding the mediator "Community attachment" did not significantly alter the path coefficient and there was no significant

association between “Message posted” and “Community attachment” ($\beta = -0.109, p = 0.068$). Therefore, we conclude that there is no statistically significant mediation in this model¹.



¹ We also analyzed an alternative model with Community Attachment as a moderator on the relationship between participatory behavior and emotional distress. We centered the variables and included four interaction items in the PLS model. The analysis results were as follows: Time On Site x Community Attachment ($\beta = 0.015, t = 0.034, p = 0.973$), Number of postings x Community Attachment ($\beta = -0.113, t = -0.287, p = 0.774$), Visit Frequency x Community Attachment ($\beta = 0.017, t = 0.038, p = 0.969$), and Membership Tenure x Community Attachment ($\beta = -0.595, t = -1.982, p = 0.048$). Although the last interaction item had a marginal p value, the direct effect of Membership Tenure on Community Attachment was not significant ($\beta = 0.573, t = 1.810, p = 0.071$). We thank one of the reviewers for suggesting this analysis.

Table 4. Hypothesis Testing Results

Hypothesis	β	<i>t value</i>	<i>p value</i>	Hypothesis supported?
H1: Community attachment → Emotional distress (-)	-0.226	-2.903	<0.01	Supported
H2a: Participation: Number of postings → Community attachment (+)	-0.109	-1.828	0.068	Not supported
H2b: Participation: Visit frequency → Community attachment (+)	-0.028	-0.423	0.672	Not supported
H2c: Participation: Time on site → Community attachment (+)	0.290	6.336	<0.001	Supported
H2d: Participation: Membership tenure → Community attachment (+)	0.030	0.777	0.437	Not supported
H3: Reciprocity → Community attachment (+)	0.329	5.07	<0.001	Supported
H4: Gratitude → Community attachment (+)	0.335	4.333	< 0.001	Supported
Participation: Number of postings → Emotional distress	0.333	4.828	< 0.001	
Age → Emotional distress	0.320	4.132	< 0.001	

Note: Gender, Education, Diabetes type, and Years of illness have no statistically significant relationship with Emotional distress.

Discussion of Results

The main purpose of this study is to examine how participating in OHCs may help reduce emotional distress through establishing a sense of community attachment. In contrast to prior studies that examined the direct association between OHC participation and emotional support

(e.g., Johnston et al., 2013), we posit that OHC participants benefit emotionally only when they develop a sense of attachment to the community through positive interaction experiences with other OHC users. Our data show that the more a DCUK participant perceives the help-giving as reciprocal ($\beta = 0.329, p < 0.001$) and the more they feel grateful for being helped ($\beta = 0.335, p < 0.001$), the more likely they will develop a sense of attachment toward the OHC. This community attachment, in turn, is negatively associated with emotional distress ($\beta = -0.226, p < 0.01$). Interestingly, neither reciprocity nor gratitude had statistically significant relationships with emotional distress directly ($t = 0.083$ and 0.046 , respectively, $p > 0.05$). This might be due to the fact that normative belief and affective reaction could also arise from limited interactions, which might not have a long-lasting, meaningful effect on people's emotional state. For instance, a casual user of DCUK may believe in reciprocity and feel grateful when someone answers their question, but these sentiments are transient and only surface at the moment of interaction. This explanation further underlines the crucial role of community attachment in realizing the potential benefits of the prosocial norms and affects in OHCs.

There are also some interesting nuances in the relationship between participation and community attachment. Among the four measures of participation, only "time on site" had a statistically significant association with community attachment ($\beta = 0.290, p < 0.001$). More interestingly, in our mediation analysis, the amount of time a DCUK user spent on the site did not have a significant relationship with their distress level ($\beta = 0.071, p = 0.433$). Taken together, these results indicate that the more an OHC participant hangs around in the community, the more likely they will develop an emotional bond with the community, which in turn will support their emotional needs in terms of easing distress. However, without developing an emotional bond, simply spending more time on the site is unlikely to lead to reduced distress. This finding corroborates with Chen et al.'s (2019) conclusion that patients may not benefit, informationally or emotionally, from an OHC if they are not willing to actively develop their social capital through support seeking and provisioning.

Some surprising findings have emerged from our analysis. First, visit frequency, number of posted messages, and membership tenure seem to have little to do with community attachment. A possible explanation is that a significant number of DCUK users take a utilitarian approach to OHC participation, visiting the community to extract useful information when needed, but leaving the site immediately after getting what they want without spending extra time engaging

with the community on an affective level. This utilitarian approach is not uncommon in OHCs and other online communities (e.g., Shiue et al., 2010). Another possible explanation of the lack of association between message posting and attachment is that those who have formed friendship links with other DCUK members might choose to communicate via private messaging rather than posting publicly.

Another surprising finding is the positive relationship between “Number of postings” and “Emotional distress” ($\beta = 0.333, p < 0.001$) in the mediation analysis. In other words, posting more messages in OHC associates with increased, rather than reduced, emotional distress. In this regard, we add to the evidence that OHC participation may not always result in psychological wellbeing (Batenburg and Das, 2015). A possible explanation is that emotionally burdened diabetes patients are more likely to post messages in DCUK to seek information and comfort. Although the directionality of the effect is difficult to assess without a controlled experiment or longitudinal study, the finding does serve as a reminder of the possible dynamics between OHC participation and its consequences.

Finally, among the covariates included in the path analysis, only age has a statistically significant association with emotional distress ($\beta = 0.32, p < 0.001$); that is, older people are more likely to experience emotional distress than younger people living with diabetes. Based on prior research on aging, we think that socioeconomic and other health constraints due to aging are likely to have contributed to distress (Kunzmann et al., 2000). Diabetic people’s emotional distress seems to have little to do with their gender, educational level, type of diabetes, or how long they have had the condition.

Implications

This paper extends previous research about whether and how OHC participation contributes to patients’ wellbeing (e.g., Batenburg and Das, 2015; Taiminen, 2016; Yan and Tan, 2014). First, we theorize and empirically test that OHC users who experience a sense of community attachment are more likely to benefit emotionally from their participation in OHCs. Second, the study demonstrates the importance of sociopsychological mechanisms such as reciprocity and gratitude for the development of community attachment in OHCs. Finally, we show that not all types of participatory behavior have a significant association with emotional

distress and community attachment. These empirical findings have both theoretical and practical implications.

Implications for Research

To the best of our knowledge, this is the first study systematically looking at how attachment to an OHC may help patients reduce emotional distress. Although existing healthcare and OHC literature provides ample evidence of an OHC's positive role in supporting patients online (e.g., Huang et al., 2019), there are also plenty of nuances and mixed findings. For example, the emotional benefit of OHC participation is found to be less evident in users with poor mental health (Yan and Tan, 2014) or pressing health-related concerns (Batenburg and Das, 2015). We contribute to this line of discussion by focusing on a previously overlooked mediating role of community attachment in realizing an OHC's potential in supporting emotional wellbeing. We show that behavioral, normative, and affective factors commonly seen in the OHC literature have little to do with emotional distress directly; instead, it is the OHC participant's formation of community attachment that makes the difference.

Moreover, whereas extant research has modeled community attachment (or similar constructs such as community commitment) as a predictor of OHC participation (e.g., Bateman et al., 2011), we focus on the other side of the story: that is, participation in an OHC leads to a bonding to the community. This is in line with Tonteri et al.'s (2011) work, showing that participatory behaviors influence sense of community; however, their model only considered the two behavioral indicators – reading and posting messages. Our study examined more participatory behaviors to provide a more complex picture. We show that posting, often regarded as the most important behavioral indicator of active engagement, is not associated with community attachment. It is important to note that some posts require more effort (e.g., a detailed account of personal illness experience) than others (e.g., a one-line question or a “thank you” message). In this regard, we argue that “time on site” may be a more reliable proxy of the level of participation in OHCs, which accounts for all activities the participant performs attentively on the site including posting, replying, and reading.

In addition to the behavioral dimension of OHC participation, we draw on social exchange theories to open up more venues for studying sociopsychological factors that foster community cohesion and emotional wellbeing. We show the relevance of the norm of reciprocity and the

effect of gratitude – both key mechanisms in generalized social exchange – in understanding how OHC participants develop a strong bond with the community, which in turn supports a greater subjective wellbeing. Online community researchers have studied the norm of reciprocity, and to a lesser extent, gratitude (Makri and Turner, 2020), but few have delved into how the expectation of equitable reciprocation and the feeling of gratitude in social interactions may contribute to patients’ wellbeing in an OHC (Armstrong et al., 2011). In particular, very few IS scholars have considered gratitude as a distinctive sociopsychological factor and its implications for OHC research, despite the abundance of thankful messages in OHCs and other online communities. To this end, we echo Watkins et al.’s (2006) call to disassociate gratitude from indebtedness in social exchange and pay closer attention to “one of the most understudied emotions in psychological science” (p. 217).

We did not find supporting evidence that OHC participation helps emotional wellbeing directly, except for a positive association between posting behavior and distress. On the one hand, this observation seems to confirm the conclusion in most “lurker” studies that the intensity of participation made little difference in terms of benefiting from the community (Mo and Coulson, 2010; Nonnecke and Preece, 2000). On the other hand, the seemingly negative effect of posting on emotional wellbeing underlines the fact that it is not the “lurking versus posting” that predicts the benefits of using OHC. Therefore, it is not surprising to see Han et al.’s (2014) discovery that many lurkers in an online cancer support group performed better than posters in terms of psychological outcomes, after they had developed a long-term commitment to the group. Our observation also corroborates with a study on offline support in Canadian neighborhoods, where the frequency of residents’ neighboring behavior was not directly predictive of their sense of wellbeing but was predictive of increased sense of community (Farrell et al., 2004). To summarize, our research points to more complex behavioral, normative, and affective factors in explaining or predicting emotional outcomes of participating in OHCs.

Implications for Practice

Our work also has implications for chronic care providers as well as managers of OHCs. Our findings add to the evidence that patients participating in OHCs can indeed benefit emotionally from the communities, in addition to informational benefits documented in the prior literature. Our empirical findings suggest that a patient does not have to be a prolific content

contributor to benefit emotionally from an OHC. If they spend time hanging around on the site, adhere to the norm of indirect reciprocity, and experience gratitude as a result of content consumption, they could develop an attachment to the community that helps ease their health distress. In light of strained offline healthcare resources for long-term chronic disease patients, healthcare providers could encourage and guide patients to participate in OHCs for social support. Health programs should equip patients with health literacy and digital skills to use the OHCs and benefit from online social support.

OHC managers need to look beyond some of the commonly used metrics, such as monthly visits and number of new postings, and focus on fostering a sense of attachment among existing users in order to fulfill the community's potential of emotional support. Our study implies that design features facilitating reciprocation and gratitude expression among users may strengthen an emotional bond. For example, OHCs could automatically remind a user who has recently received help from the community to post a thankful reply and encourage them to return the favor by helping other community members in need. OHCs can also experiment with innovative features that keep users engaged with the site for longer in meaningful and emotionally satisfying ways. For example, gamification in digital health interventions has proven to be an effective design approach to engage patients and to influence health behavior (Fleming et al., 2017). Allam et al. (2015) have even shown that online social support and gamification can work together to empower patients with chronic conditions.

Conclusion and Future Study

This study demonstrates the pivotal role of community attachment in understanding an OHC's potential of providing emotional benefits to OHC participants. Our empirical study conducted in a large OHC for people with diabetes found that the respondents were likely to be emotionally better off when there was a sense of community attachment. In addition, we examined how participatory behaviors, reciprocity, and gratitude are associated with a sense of community attachment. We also found that the usual behavioral measurements of online participation, such as visit frequency and number of postings, might not be reliable indicators of community attachment or emotional wellbeing.

Due to practical and theoretical considerations, this study left out some issues that could be addressed in future work. A particular challenge with studying online social support is a large set

of potential covariates that cannot be effectively controlled (Moorhead et al., 2013), and the online and offline boundary is increasingly blurred. Further research, ideally through accurate tracking of user behaviors, is needed to gain a more accurate picture of what activity OHC participants are performing on the site and for how long. The empowering effects of online support may also be moderated by physiological mechanisms such that some patients feel particularly vulnerable and therefore in need of intensive social support (Uchino, 2006). A controlled experiment or a longitudinal study could help isolate different variables and establish a convincing causal link between OHC participation and the anticipated benefits.

Similarly, an experimental or longitudinal approach would also help pin down the directionality of effects between the behavioral and sociopsychological factors. Meyer and Allen (1991) acknowledge two traditions in organizational commitment research: attitudinal and behavioral. The two traditions or approaches have “obvious differences” in the “examination of the ordering of variables and the primary causal relations” (p. 62), but they caution that “both approaches include secondary relations ... which imply that a complementary set of processes may be involved in the commitment-behavior link” (p. 62). In Talò, Mannarini and Rochira’s (2014) meta-analysis of the relationship between sense of community (SoC) and community participation, they expressed a similar view: “Despite evidence attesting to the association between SoC and community participation, the strength of this relationship is still unknown, and the direction of such a relationship is not obvious. The majority of the empirical studies have considered participation as a dependent variable, but theoretical approaches have assumed the existence of a *circular relationship* between these two variables: SoC enhances active citizen participation, which in turn reinforces SoC” (p. 5). While previous studies on OHCs usually treat SoC (or similar constructs) as a priori psychological state in evaluating its effect on users’ online behavior, we take what Meyer and Allen called a “behavioral approach” by focusing on how behavioral and other factors affect attachment; nevertheless, we acknowledge a potential “circular relationship” or feedback loop in the proposed research model.

We looked at the quantity of postings by a DCUK participant but did not consider the actual content of the messages. People in the forums may ask questions, answer other people’s questions, share a personal story or a medical publication, or simply engage in casual social interactions for companionship. Given millions of messages posted on the OHC, data mining techniques with natural language processing (NLP) and sentiment analysis would help shed light

on the content and quality of interactions (e.g., Chen et al., 2019). How each type of message supports the development of attachment and emotional wellbeing would be an interesting empirical question to investigate.

Finally, since this study was conducted within one online community for people with diabetes, it is unclear whether the findings reported here are generalizable to other OHCs. For example, emotional wellbeing might be more difficult to achieve in the case of mental health patients (Yan and Tan, 2014). Nevertheless, we hope our observation of different dimensions and forms of OHC participation and the importance of community attachment can provide transferrable insights into studying similar OHCs for chronic diseases.

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Appendix: Survey Questionnaire Items

Emotional Distress

- I feel that diabetes is taking up too much of my mental and physical energy every day.
- I feel angry, scared, and/or depressed when I think about living with diabetes.
- I feel that diabetes controls my life.
- I feel that I will end up with serious long-term complications, no matter what I do.
- I feel overwhelmed by the demands of living with diabetes.

Community Attachment

- I feel a sense of belonging towards the Diabetes.co.uk community.
- I have a feeling of togetherness in this community.
- I have a strong positive feeling toward this community.
- I am proud to be a member of this community.
- I have a real emotional attachment to this community.
- This site has a great deal of personal meaning for me.

Reciprocity

- When I contribute knowledge to the Diabetes.co.uk community, I expect to get back knowledge when I need it
- When I share my knowledge on the discussion forums, I believe that my queries for knowledge will be answered in future
- I know that other members in the community will help me, so it's only fair to help others

Gratitude

- How grateful do you feel toward those who have helped you on the forum?
- How appreciative do you feel toward those who have helped you on the forum?
- How positive do you feel toward those who have helped you on the forum?

Community Participation

- Membership tenure
How long (in months) have you been a member of the Diabetes.co.uk forum? (You can find this number by going to your profile)
- Number of postings
How many messages in total have you posted on the forum? (You can find this number by going to your profile)
- Time on site
In a typical week, approximately how much time (in minutes) do you spend on the Diabetes.co.uk forum?
- Visit frequency
How frequently have you visited Diabetes.co.uk forum in the last three months? (1 = not once; 2 = once or twice in the last three months; 3 = once or twice a month; 4 = once or twice a week; 5 = several times a week; 6 = once or twice a day; 7 = several times a day)