J Med Syst (2013) 37:9942
DOI 10.1007/s10916-013-9942-7

ORIGINAL PAPER

Facebook as a Platform for Health Information and Communication: A Case Study of a Diabetes Group

Yan Zhang · Dan He · Yoonmo Sang

Received: 18 December 2012 / Accepted: 18 March 2013 / Published online: 16 April 2013

Abstract As one of the largest social networking sites in the world, Facebook holds a great potential for promoting health. In this exploratory study, we analyzed 1352 messages posted to an active Facebook diabetes group to identify the characteristics of the group. The results revealed that the group was international in nature. Users overcame language barriers to communicate with people with similar conditions. Users' interactions were structured around information, emotion, and community building. They exchanged medical and lifestyle information, and highly valued their peers' personal experiences, opinions, and advice. They also demonstrated a positive attitude toward the reality of living with diabetes and generously provided encouragements and affirmations to one another. Great efforts were made to maintain the proper operation of the community by the administrator and a group of core members. As a result, the group was shaped as a social network where peer users share social support, cultivate companionship, and exert social influence. Based on the results, we discussed future directions for research of health communities in a highly connected world.

Keywords Facebook · Diabetes group · Online health communities · Consumer health informatics

Introduction

Social networks and health are closely related. The social cognitive theory posits that one's lifestyle and health-related behaviors are shaped by observing and modeling others' behaviors, and social reinforcement comes from the behaviors [1]. Similarity, the theory of reasoned action (TRA) suggests that subjective norms, that is, individuals' beliefs about whether a particular health behavior is desirable in the eyes of close social ties, is an important determinant of their intention to perform or change the behavior [2]. Furthermore, social networks influence one's health by providing four broad types of support: emotional, instrumental, informational, and appraisal [3]. Such support could help improve one's abilities to cope with stressful health challenges, leading to a better health outcome [4].

Over the past few years, Web-based social media, particularly social networking sites (SNSs), have grown substantially. Such growth, to a great extent, removed time and space barriers for people to connect with one another, providing great potential for them to maintain existing social ties and expand social networks. Recent studies have demonstrated that social networking functions were effective in improving users' access to health information [5], engaging families in lifestyle changes [6], and motivating weight loss [7].

The most remarkable development in the social media space is the fast and continuous growth of Facebook. In the U.S., more than 65 % of the Internet users use Facebook to update personal statuses, follow friends, or share information [8]. Worldwide, one in 7.7 people has a Facebook account, and close to 530 million are daily active users [9]. The use of Facebook also breaks into the health domain. Among U.S. Facebook users, 23 % have followed friends' personal health experiences or updates, 15 % have retrieved health information on the site, and 9 % have started or joined a health-related group [10].

As such, Facebook holds a great potential to influence individuals' health behaviors by shaping their perceptions of social norms and the expectations that they set for themselves, or by improving their access to personally relevant information [11]. Recent research has looked at how users use Facebook, as a generic SNS, for health information, why they use it, and their perceptions of the usage [10, 12, 13].

Y. Zhang (✉) · D. He
School of Information, University of Texas at Austin,
1616 Guadalupe Street,
Austin, TX 78701, USA
e-mail: yanz@ischool.utexas.edu

Y. Sang
College of Communication, University of Texas at Austin,
300 W. Dean Keeton,
Austin, TX 78712, USA

However, few studies focused on examining another medium on Facebook for health communication: health groups. These groups are communities formed based on common health interests rather than on a person's generic social ties. To fill this gap and shed light on the characteristics of health communities on Facebook and understand their potential for promoting health information exchange, we conducted a case study on a large and active diabetes group, named *Diabetes*, on Facebook. Diabetes is a very common and costly chronic illness affecting people of all ages [14]. Social support is important in managing the disease and promoting compliance with a strict maintenance regime [15].

Literature review

Online health communities

Since their inception in the 1990s, online communities, in various forms, such as chat rooms, listservs, bulletin boards, newsgroups, and Web forums, have served as a platform to bring together users with similar health conditions or health interests, such as breast cancer, keen injury, or weight loss. In light of the concepts of social support and weak ties, as well as the computer-mediated communication theory, Wright and Bell [16] pointed out that health support groups are weak-tie networks and their participants share similarity and sympathy to one another. As such, facilitated by features of the computer-mediated media, those who need support can actively communicate with others who share the same concerns.

Empirical studies suggest that online health communities could be a valuable source of information. Users in these communities exchange information and personal stories and help inform one another in subjects ranging from symptoms, diagnoses, medications, and side effects, to information resources, doctors and clinics, financial helps, and daily life advice [17, 18].

Numerous studies suggest that online health communities also provide emotional support to patients dealing with difficult health issues [19, 20]. For instance, in exploring the effects of insightful disclosure on outcomes in peer-led Internet breast cancer support groups, Shaw et al. [21] found that insightful disclosure led to reduced negative mood and improved emotional well-being among users of the groups. Insightful disclosure, however, had no relationship with breast cancer-related concerns and physical well-being. In another study, Bond et al. [22] demonstrated that by participating in a Web-based online community, a group of elderly adults (>= 60 years old) with diabetes showed significant improvements in quality of life, depression, and self-efficacy.

Anonymity seems to be another benefit of online health communities. A great amount of research has demonstrated that people with stigmatized diseases, such as AIDS, STDs, prostate cancer, and mental disorders, perceive online support groups as a safe platform to seek and share information and help [23, 24].

SNSs and health

SNSs are Web-based services that allow individuals to post profile information, construct a list of friends, and communicate with others using both synchronous and asynchronous messaging tools [25]. In the past few years, the use of SNSs emerged as one of the prominent social trends. As of 2012, 66 % of adult Internet users in the U.S. have used SNSs [26].

SNSs are different from traditional online communities in that their users are more likely to use them to satisfy social-emotional needs rather than informational needs. At the same time, because SNSs are built based on ones' existing social ties, the interpersonal relationships on a SNS tend to be more intense than on general online communities, where users were often brought together by a common interest [27]. Nevertheless, consumers are turning to SNSs for health information and updates on the health of loved ones [10]. Healthcare providers are also increasingly turning to social networking tools, such as Twitter, to circulate health information, as well as inform and engage patients and the general public [28, 29].

Given the fast permeation of SNSs into the health domain and the strong diffusion power these tools have, a deeper understanding of SNSs as a venue for fulfilling people's health-related needs and impacting public health becomes necessary. Some researchers have begun to examine consumers' use of SNSs and the implications for health promotion and health information seeking [28–30]. For instance, by interviewing thirty-eight college students, Zhang [13] examined how college students use SNSs to seek health and wellness information and how they perceive this usage. It was found that health-related use of SNSs was not a common behavior among the students. Furthermore, these sites, particularly Facebook, were not perceive as an appropriate or trustworthy venue for health-related information.

In a similar vein, Newman et al. [12] found that Web users intending to lose weight posted their exercises on their Facebook Walls, became fans of weight loss communities, and invited friends they knew from other online communities to their Facebook network as a way to be continuously connected and engaged with them. Nevertheless, although they generally felt that Facebook friends were able to provide more accountability, due to a concern about self-image, they favored other online communities where they could remain anonymous.

SNSs' use for diabetes

Relatively little is known about the use of SNSs in the context of diabetes. Several recent studies address some of

the issues related to this subject [30–33]. For example, to understand how diabetes communities operate, Shrank et al. [32] evaluated fifteen popular SNSs for diabetes (e.g., diabetescommunity.dlife, healthcentral.com/diabetes, and diabeticconnect.com). They found that these sites varied considerably in the quality and authenticity of the content, participation of healthcare professionals, promotional activities, and funding sources. The communication structure, namely the presence of site administrators and their roles, also varied greatly.

To evaluate the communication in communities dedicated to diabetes, Greene et al. [30] reviewed 233 wall posts and comments and 457 discussion topic comments from ten groups on Facebook. They found that patients with diabetes, their family members, and their friends were actively using these groups to request information (13.3 % of the messages), provide information (65.7 %), and provide various support (28.8 %). At the same time, the researchers evaluated the quality of the information being shared in these groups and found that clinically inaccurate recommendations were infrequent, but were often associated with promotion of a specific product or service.

To contribute to the existing knowledge of online health communities, this study seeks to gain a better understanding of how users on a Facebook diabetes group, *Diabetes*, engage with one another. Diabetes was chosen as the subject area for the study is because the illness is one of the most common chronic conditions, affecting a large number of people at different ages [14]. Moreover, successful management of diabetes requires continuous efforts from patients or caregivers, which makes patients with diabetes or their caregivers more likely to engage in online communities. We will explore the following research questions:

1) What are the characteristics of the Facebook diabetes group? Specifically, who are the participants and what activities do they perform in the group?
2) How do users interact with one another in the group?

Answers to these questions will enhance our understanding of users' online interactions about health in general and diabetes in particular on the Facebook platform and shed light on how to leverage social networking functions to support people's efforts to live with diabetes.

Research methods

Data collection

Using the Facebook search function, we searched for the keyword "diabetes." We selected the first group that appeared in the search results. The group was named *Diabetes* (Fig. 1), an open group that anyone with a Facebook account can join or "like." It was launched in February 2008 and had more than 30,000 users at the time of the study, which made it one of the largest groups on Facebook focused on people with diabetes or people who were affected by diabetes. On another site that links to the group *Diabetes*, the founder described the group as "Diabetics for Diabetics" and mentioned that he/she began this group because he/she "did not really have a lot of information from the hospital and started talking to others that were on Facebook."

To determine whether the group was active, beginning in August 2011, we followed it for a few weeks, observing users' interactions in the group. We found that the participants of the group were actively posting messages and responding to peers, and the number of participants was increasing steadily.

To further understand how users use this group and the group dynamics, we took a snapshot of the group activities by manually collecting messages, both posts and comments, posted onto the group's Wall for 1 week, from Sunday, September 25, to Saturday, October 1, 2011. This was a typical week during the year. Thus, we believe that this snapshot effectively represents the normal group activities. In addition to the content of the messages, we also collected various attributes associated with each message, including the author, time posted, and the number of likes. (The data collection took about 2 weeks in late October 2011. Because there were no time stamps associated with likes, the number of likes collected was the number of likes each message had received by late October). In total, 1352 messages on the group's Wall, including 154 posts and 1198 responses/comments, were collected and the messages were stored in a database.

Data analysis

The messages were imported into content analysis software, QSR, and the qualitative content analysis method was employed to analyze the data [34]. The method was chosen because it allows themes to emerge from the data. A message, either a post or a response, was defined as the coding unit. Both top-down and bottom-up approaches were utilized to conduct the content analysis. Specifically, the following procedure was followed: (1) Before the coding began, we read the messages a few times to gain an overview of the overall content; (2) We then reviewed existing literature on patient-centered diabetes forums [30] and compiled a coding schema from the literature. This coding schema consists of four top categories: providing information, requesting information, advertisements, and emotional support; (3) Guided by this coding schema, we coded the messages into these general categories; (4) At the same time, the open coding method was employed to code the themes and subjects that were not covered by the derived coding schema. If a message contained multiple themes, it was coded multiple times. As a result of this bottom-up practice, a coding schema that better represents this data set

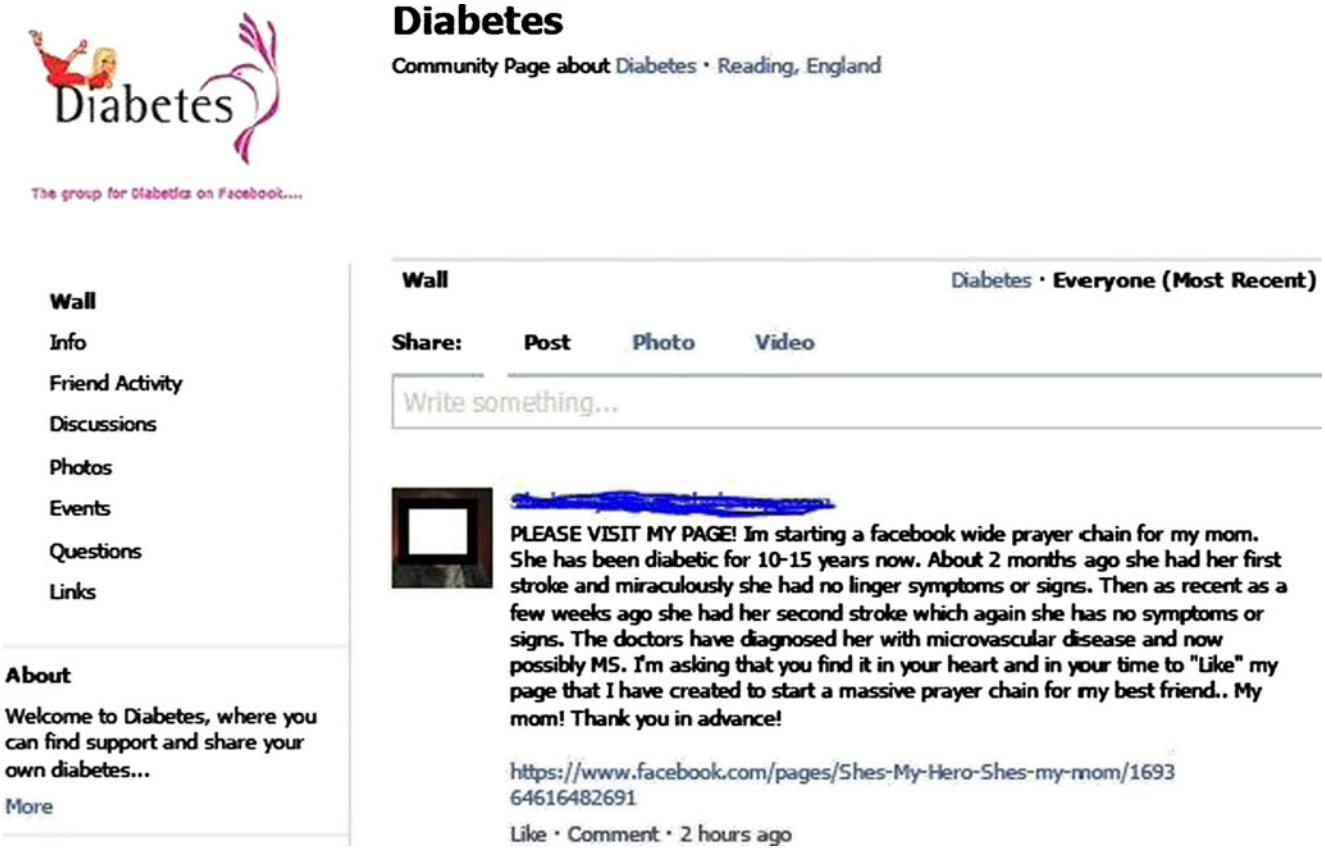

Fig. 1 Group wall of diabetes (Users' name and profile image are blinded)

was constructed; (5) Using the schema, two coders independently coded part of the messages. A series of discussion sessions were held between two coders to discuss differences among categories as well as the discrepancies between the two coders. The discrepancies were mainly about coding a text unit as expressing emotions or as seeking emotional support, as these two categories often interweaved with one another. We decided to code a text unit as seeking emotional support only when it explicitly asks for it. This process improved our understanding of the properties and dimensions of the categories, as well as produced a more well-defined coding schema; (6) The same two coders completed the coding task using this new coding schema, with one coding all the messages and the other coding 20 % of the data. The inter-coder reliability, that is, the percentage of codes that agreed by both coders, was 85.2 %. The discrepancies were solved by discussions between the two coders.

Results

Characteristics of the group

Online communities are generally defined as "a cyberspace supported by computer-based technologies, centered upon communication and interaction of participants to generate member-driven contents" [35]. This definition suggests that community participants and online interactions are two major elements that characterize an online community [36]. Thus, we describe this Facebook group from two aspects: group participants and their activities and interactions.

Group participants

At the time the data were collected, the group *Diabetes* had 31,860 members. The study sample consisted of 1352 messages posted on the group's Wall. They were contributed by 479 unique participants (M=2.82). The examination of participants' profiles that were publicly accessible revealed that they were from all over the world, including the U.S., U.K., Australia, Ireland, Canada, Brazil, Dubai, Spain, Philippines, and South Africa. The vast majority of the messages were in English, but ten were in other languages, mostly Spanish and French. A couple participants explicitly mentioned that they had used online translators to translate their messages to English.

The participants had different social roles. The majority were patients with diabetes, with some being newly diagnosed and others having lived with diabetes for years. Caregivers, mostly family members, were the other major users

of the group. Among them, most identified themselves as mothers who cared for young children with diabetes. The participants also included several other diabetes groups on Facebook, such as *Diabetes Education* and *Diabetes Corner*. Three participants posted messages to promote a dance therapy, a book, and a non-profit organization. We also found one researcher at a university looking for suggestions for designing insulin pumps.

Activities and interactions in the group

Functions available in the group were similar to those available to individual Facebook users. The primary ground for interactions was the groups' Wall. Participants could post messages on the Wall (post), respond to others' messages (comment), like one's posts or responses, read messages, or share a post to their own Wall, to a friend's Wall, to a group, or to anyone through a private message. Participants could also interact with one another on a discussion board by initiating a discussion topic or responding to the initial posts and any subsequent comments (This function ended after October 31, 2011). Table 1 shows participants' activities during the week of data collection. Since it was not possible to track the sharing and reading activities, they were listed as unknown.

During the week, participants posted a total of 154 posts to the Wall. These posts were not all in text format. Rather, they included text, images, or a combination of the two. Some posts also included links to one's own blog or medical websites. Among the 154 posts, 136 (88.3 %) received 1198 responses or comments from peers (M=8.8). It is worth noting that the majority of the messages (77.7 %) were contributed from Monday to Thursday with the peak on Wednesday. The activities hit the lowest point on Friday (6.4 %) and picked up a little on Saturday and Sunday (15.9 %).

Although the meaning of "like" a message was not explicit, this expression is often associated with a fond or supportive affection. During the week of data collection, a total of 1710 "likes" were given and it was highly skewed toward a small number of messages: only 240 (17.8 %) messages, among the 1352, received "likes" from peers, and the top ten most-liked messages received 73.9 % of the "likes" (1263).

Participants also had three updates to three different discussion topics on the discussion board. The topics were Mountains for Actives Diabetics, UK/USA Glucose Converter, and Diabetes Support. In this paper, we focus on analyzing messages posted on the Wall.

Table 1 Activities participants performed in the group

Activities		No. of Mesg.
Posting	Contained text	149
	Contained images	7
	Contained links	7
Responding/Commenting	Contained text	1198
	Contained links	4
Liking		1710
Discussing		3 topics
Sharing		Unknown
Reading		Unknown

Themes of user interactions on the wall

Based on the analysis of the 1352 messages, we identified that users' interactions on the Wall were mainly structured around three elements: information, emotion, and community building. For information, participants intended to elicit information from or provide information to peers. For emotion, they intended to express their own emotions, seek emotional support from peers, or provide support to others. For community building, participants intended to make the community function properly. Figure 2 shows the distribution of these themes. When a message contained multiple themes, the message was counted multiple times. The numbers refer to the number of messages in each category and the corresponding percentage.

Approximately 74 % of the messages were related to information, with the majority intending to provide information. About one-fourth of the messages had to do with emotions, with a focus on expressing emotions and providing emotional support. Very few participants explicitly sought emotional support. About 5.4 % of the messages were about community building. Messages promoting products or eliciting information for research projects were not counted into any of these categories. In the following subsections, we elaborate on these major themes.

Information

Eliciting and providing information were examined in relation to two distinct dimensions of information: subject and type.

Eliciting information: Subjects In 164 messages, participants attempted to elicit information from peers. The major categories of subjects requested and their distributions are shown in Fig. 3.

Over half of these messages (57.9 %) asked for medical information, including symptoms, complications, diagnoses, tests, and treatments and medications. For symptoms, participants often described symptoms or complications, such as headaches, random sweats, and vision changes, and asked what these symptoms indicated. For tests, they mainly asked peers what their blood sugar and A1C readings were, when and how frequently they checked these readings, and what a certain reading

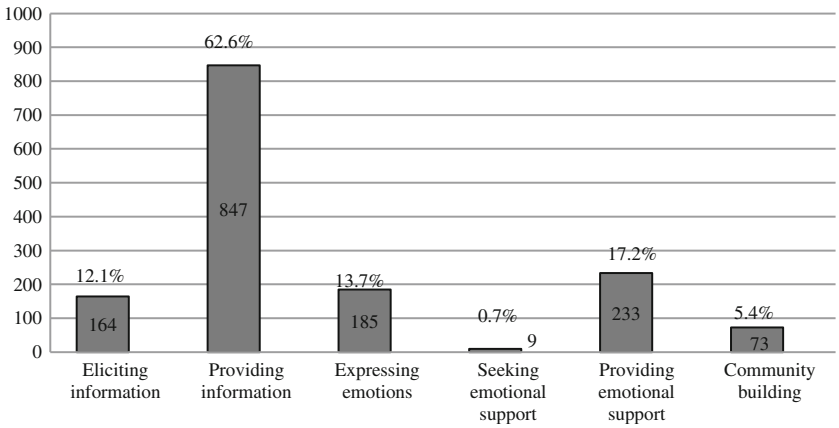

Fig. 2 Themes of interactions

meant. For treatments and medications, the focus of interest was peers' experience with medications, changes in medications, and insulin delivery methods (e.g., pump and pen).

Lifestyle, specifically diets and workout, was the second most requested subject (20.1 %). Participants were interested in knowing what peers ate, their diet habits (e.g., skipping breakfast), or amount of exercise. Sometimes, they were also concerned about what food worked and why. For example, after one participant reported that drinking orange juice prevented her blood glucose value from going down, another asked: "Do you know if it is because of the fructose in the orange juice? [Could I] eat some fruits like an apple instead?"

Seventeen messages (10.7 %) asked for peers' experiences and advice for dealing with diabetes in their daily lives. Typical questions included how they dealt with diagnoses emotionally, how to better control day-to-day lives, and how to deal with family members or employers who were not supportive of the patient's care. Diabetes tattoos were a subject that ignited lively conversations in the group, and the majority of questions had to do with the color and design of tattoos.

Participants also asked questions concerning information sources for the disease (what sources to refer to and how to use some sources); finance and policies, mostly concerning government policies of helping patients pay for medications; and other subjects, such as iPhone apps to help teenage patients manage their conditions.

Eliciting information: Types The major types of information requested by the participants are shown in Fig. 4.

Personal experiences were the most requested type of information (58.0 %). It seemed that this type of information was mainly used for a comparison purpose. In many cases, participants described their own workouts, diets, or blood glucose and A1C readings, and asked for peers' status or readings. In other cases, they described their symptoms or reactions after an insulin injection or medication intake and asked peers whether they had similar experiences. For example,

> Does anyone else feel like they have a hangover like an hour after a [hypoglycaemia]? I got bad headaches and really tired […].

About 22 messages (14.7 %) surveyed peers' personal opinions of a concept or product. An example was "What do

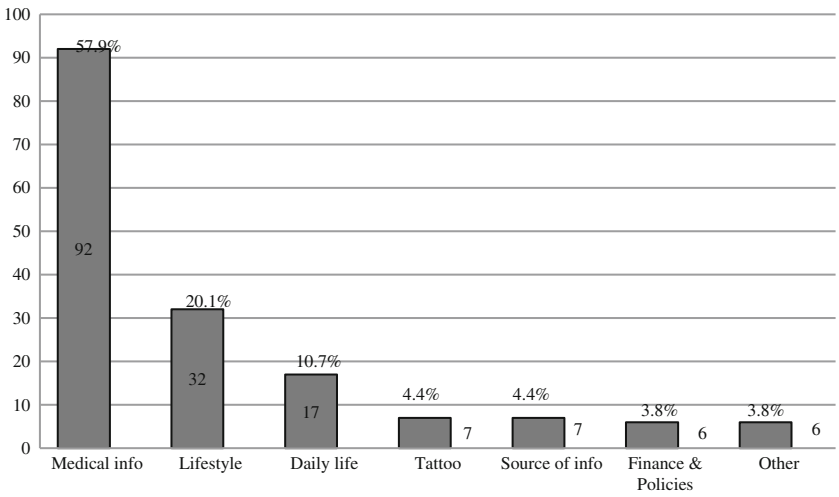

Fig. 3 Eliciting information: Subjects

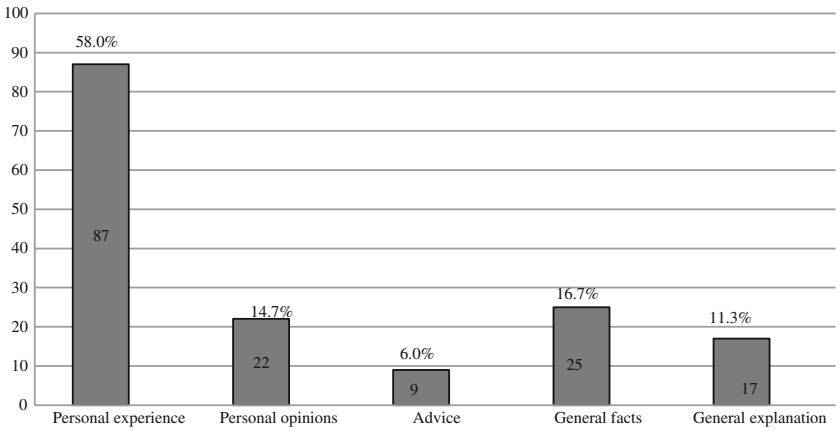

Fig. 4 Eliciting information: Types

you call healthy food?" Nine messages (6.0 %) asked for practical advices from peers, such as how to handle feelings of sickness, how to stop irritation and itchiness when changing the insulin injection site, and how to control sugar levels.

Other than personal experiences, opinions, and advice, participants also sought factual information, such as definitions of a medical term (e.g. "what is type 1.5?"), the difference between European and American blood sugar scales, or an information source (e.g., Type 2 Diabetes Support Group). Unlike the previous three information types, factual information tends to be more objective. The other type of information sought by participants was explanations of certain symptoms or interpretations for test readings. This type of information was often requested to answer *Why* questions, which tend to involve a greater level of ambiguity, compared to fact-seeking questions.

Providing information: Subjects In 847 messages, participants provided information to peers. Two types of providing behaviors were identified: (1) providing information without being asked by others. We term this behavior *voluntary reporting*; and (2) providing information in response to others' questions. The same schema used to code the subjects of messages eliciting information was applied to the providing-information messages. Figure 5 shows the coding results.

In 502 messages (59.3 %), participants were voluntarily reporting information. Similar to eliciting information, the major subjects included medical information, mostly one's own blood glucose readings, medications, and symptoms; and lifestyle information, including diets and exercises, tattoos they got, and day-to-day challenges of living with diabetes. It is worth noting that participants also voluntarily shared information about financial, informational, or material aid available to diabetes patients. For example, one member posted: "If you register (your blood glucose meter] with something like Accu-Chek then the replacement batteries are free."

In 355 messages (41.9 %), participants provided information in response to peers' requests. The subjects provided in response to requests were similar to those voluntarily reported. There were some overlaps between these two categories because some messages contained both behaviors.

Providing information: Types The same schema used to code types of information elicited by participants was applied to code types of information provided by them. The coding results are shown in Fig. 6.

Two types of messages, voluntarily offering information and responding to others' questions, provided the same types of information. In terms of personal experiences, participants shared test readings and general experiences with diabetes treatments and maintenance. In terms of personal opinions, group members expressed opinions concerning issues ranging from the cost of medications and amount of insulin taken, to the design of diabetes tattoos. In terms of advice, they offered practical advice to peers who had medical or life concerns.

Nevertheless, as shown in the figure, messages voluntarily reporting information outnumbered those responding to requests, in all three categories. This fact suggests that the group was a supportive environment where participants were eager to share personal information, offer help, and watch out for one another. The instance most reflective of this behavior was that participants often offered advice without being explicitly asked. For example, one reported "[the doctor] has asked me to take my blood sugar [test] less [frequently]" Two other participants voluntarily offered advice against the doctor's suggestion, one wrote: "that doc is wrong to tell you that, you test as often as you need."

The remaining two types of information, facts and explanation (to symptoms or conditions), were provided with much less frequency. A departure from the previous three types, they were equally likely to be offered voluntarily or as a response to a question.

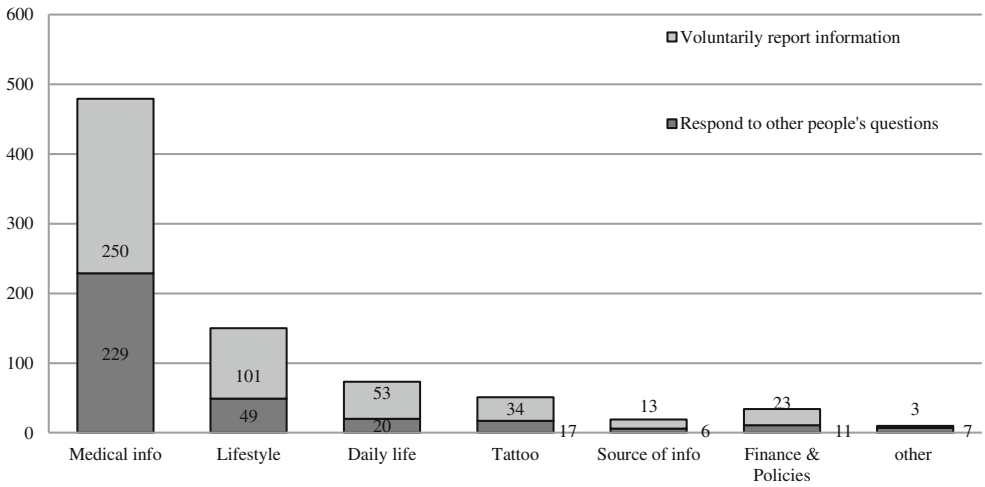

Fig. 5 Providing information: Subjects

Emotions

Expressing emotions Having a health concern is a very personal and emotional life event. Thus, it is natural for participants to express their own emotions when describing their conditions, statuses, or concerns. It was found that 185 messages contained self-expressed emotions. Within these messages, 83 contained negative, sarcastic, angry, or down emotions, such as frustration and "not feeling well"; surprisingly, 96 messages expressed positive, cheerful, and upbeat emotions. An example is "It is beautiful here – had a nice 2-mile walk – feel great :)"

Seeking emotional support Compared to expressing emotions, few participants were explicitly eliciting emotional support from peers. We identified only nine messages that could be classified into this category. Moreover, it is worth noting that eliciting emotional support was hardly the sole intention of a message. Participants often, at the same time, expected to gain practical information or help from peers. For example, when one participant tried to seek support from peers to overcome her "denial," she also implied an intention to get help on changing her situation:

> I've been a diabetic for 4 and a half year. With the exception of my pregnancy with my son, I've basically felt in denial about it all and have a very hard time WANTING to take care of myself. I mean, I know how bad it can get […] but there's still part of me that hasn't taken ownership of the disease. Like I believe it can go away just as quickly as it came. Can someone out there help me? Help me be accountable? I just don't want to leave my son and husband alone because I refused to care for myself.

Providing emotional support In 233 messages, participants provided emotional support to peers, with the majority (169 messages, 72.5 %) encouraging peers by sharing positive attitudes, providing positive confirmation to peers' statuses, or offering prayers. The encouragement and/or prayers were often offered when someone expressed difficult feelings or situations. For example, in response to the message cited in the previous section about helping with the "denial" emotion, one member commented:

> You are not alone I have been where you are and a lot of other people also. This disease can be very overwhelming

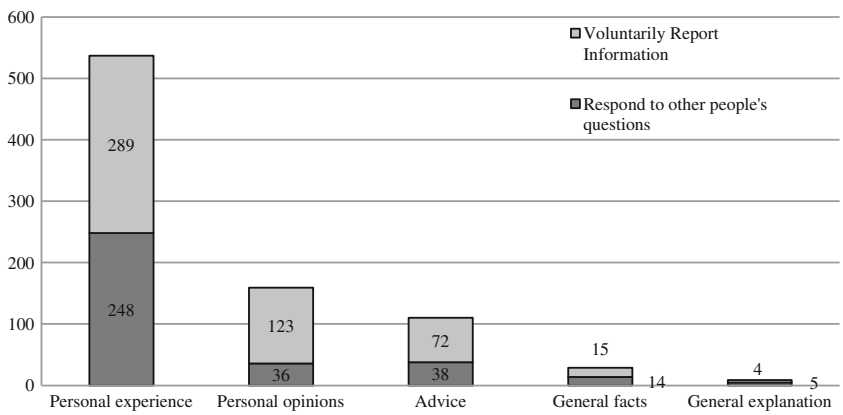

Fig. 6 Providing information: Types

> but it doesn't have to be the end – just a new beginning to a different lifestyle :) I think it is absolutely wonderful that you are reaching out for help and accountability!! Good for you:)

Another commented:

> Just make small steps each day, small steps are better than no steps at all […] I will pray for and with you.

In some cases, participants provided positive confirmations to peers' current statuses, particularly when they began a new treatment. For example, one member reported "being started on the pump", and peers offered encouragement and well wishes: "Well done and good luck, they are great"; "You will love it."

On many occasions, encouragements were not addressed to a specific person, but rather to a broader audience, including him- or herself. For example, in response to a logo depicting "I wear this ribbon because someone I love battles diabetes" posted by the admin, a dozen participants wrote uplifting messages to the group as a whole. For example, one commented: "Stay strong and have faith :)", another commented by citing personal stories "[diabetes] has changed my life and my children's life. Each day I fight the battle makes me stronger, think positive and keep smiling." Such comments reflect not only a positive lens that many members of the group have about living with diabetes, but also a form of self-reinforcement.

In addition to encouragements, in 20 messages (8.6 %), participants also showed understanding or expressed sympathy to peers. For example, one participant, Barbara, mentioned having to see an eye doctor due to the development of cataracts; a peer commented, "I am sorry to hear that Barbara :(" Another peer wrote, "Sorry, hunny." Such comments were comforting. Barbara wrote back: "Thanks for kindness […] It was nice to read this."

Community building

Another theme running through the messages was participants' efforts to create and maintain a friendly community that is useful, supportive, and trustworthy to its members. Three forces are visible in contributing to the building of the community: the admin, core members, and some general participants.

The admin The admin was the creator of the group and also one of the most active participants. As other participants, he/she posted messages, sometimes mottos and images, to lift the spirit of group members, and answered questions from peers. But at the same time, he/she functioned as a regulator, defining what constituted proper behaviors (norms) in the group. For example, he/she wrote:

> After seeing a post on another diabetes site, I just want to add that we have young diabetics on this page so I do not want to see promotion of any type for not taking your insulin, be it diet or whatever. Insulin is important and focus should be on healthy living and level control.

The admin also served as the "police" of the group, solving conflicts or abuses among participants. For example, one participant reported to him/her: "On Monday someone called Steg put a horrible comment under my post, saying my illness was because I was an alky. Can you block him from your group? […] He's trying to hack my f/b page…" The admin responded: "I went through the list and he isn't showing as added to the page, but if he does add himself and start I will ban him as I can do it straight away then."

Core group members Core group members were a small group of participants who posted frequently and, at the same time, dedicated great efforts to maintain the community. First, core group members were major contributors of the content. They actively posted messages as well as answered others' questions. The analysis suggests that the top 10 contributors contributed 30.5 % of the 1352 messages.

Second, core group members showed a strong sense of belonging to the community. For example, before checking into a hospital, a core member, Ana, posted to the group Wall: "If I do stay [in the hospital], you guys take good care of each other while I am gone, love [you all] sweet peeps", and promised that "I will ask my daughter to let you know what's going on." These core group members served as a magnet that brings people together. After seeing an update from Ana's daughter, one participant responded: "I have entered the page today just to check for updates on your mom […]"

Third, at times, some core members took a "policing" role, similar to the admin. We were not certain whether they had been promoted to the admin status (Facebook group admin can promote other group members to admins). The following quote demonstrates a core member's effort to make the community "clean": "[…] If you are selling stuff I will remove it, as I am trying to keep this site clean from people offering cures and trying to make money off of us."

General members General members also contributed to the community building. Although there were several unfriendly messages posted on the Wall, most participants were polite in their interactions with one another. They warmly welcomed new members to the group, greeted peers, thanked peers for their comments (e.g., "Thank you that is good to know."), and confronted offenses or abuses. For example, when a user used

the term *genocidal type2s* in a post, several others immediately condemned this expression.

In summary, the three forces, the admin, core group members, and general members, made this group a safe and nourishing virtual environment for its participants. For instance, one member commented that "This is a good place to learn and ask questions," while another stated "This page has definitely been nice to connect with other diabetics… very encouraging."

Discussion

Facebook has been perceived mostly as a platform for people networking with friends. Nevertheless, in recent years, a large number of online health communities have emerged on this platform. Given the vast number of users and networks that Facebook hosts, it is necessary to understand how groups on Facebook were used for health information and communication. Thus, an important contribution of our study is a demonstration of the basic characteristics of an active health group on Facebook, specifically the participants and their activities. Here we focus on discussing three major characteristics.

First, the group was highly international. Its members were from more than a dozen countries. They spoke different languages, but were able to overcome the language barrier using online translators. They exchanged information concerning challenges or policies in their own countries; they also managed to comment on each other's blood glucose levels by converting between the U.K. and U.S. scales. Such an international perspective may be cultivated by Facebook's global presence and its international user base.

Second, similar to other forms of online health communities [17], this group mainly consisted of patients with diabetes and caregivers. However, the participants of this group also included other groups on Facebook (we identified six), and these groups also contributed content. This observation suggests that groups on Facebook were highly connected with one another. Such connections may enable quick flow of information between groups.

Third, in addition to basic activities, including reading, posting, and commenting, this group provided more social networking functions, allowing users to share posts and like posts or comments. The sharing activities could not be tracked as they were not reflected on the group's Wall. However, we observed that the participants were generous in issuing "likes". Nevertheless, "likes" were highly skewed to a small number of messages, with 74 % being attributed to only ten messages.

To advance the understanding of the characteristics of Facebook health groups, we propose that future studies should (1) explore how a blend of different nationalities and cultures impact a health community, as healthcare is highly bounded by countries; (2) treat each group as a unit of analysis and examine how groups interact with one another; and (3) attempt to understand the behavior of "liking" a message and the intentions associated with it in the context of health communication.

Our second contribution is a demonstration that users' interactions in the group were structured around three elements: information, emotion, and community building. The activities around these three elements not only generated social support, specifically informational, emotional, and appraisal support, but also cultivated companionship and social influences. These ingredients worked together to enable this group, as a whole, to work toward helping its users achieve a common health goal.

Information and emotion are two common types of social support consistently reported by studies of online health communities, particularly those about chronic conditions, such as diabetes, cancer, weight loss, knee injuries, and brain injuries [7, 37–39]. The weight of the two elements varied across conditions and platforms. This study found that this particular Facebook diabetes group put more emphasis on information than on emotions, which is consistent with the findings of a recent study that surveyed ten Facebook diabetes groups [30]. In terms of informational support, users answered peers' questions or voluntarily provided information to peers. The major subjects of interest were medical and dietary information. Users valued peers' personal experiences and personal opinions the most. At the same time, they also elicited and provided personal advice, which tended to work as an appraisal mechanism to provide peers with constructive feedback or affirmation. This result could be explained by the concept of the weak tie, which suggests that peripheral acquaintances are instrumental in connecting a person to new ideas and opportunities [40].

Strong ties are instrumental in providing broader and steadier emotional support [41]. Nevertheless, emotional support from people experiencing similar problems could be particularly effective [42]. In this study, few users explicitly elicited emotional support from peers, but many provided sympathy, encouragements, and well wishes to peers. Interestingly, we also observed that many users expressed their own feelings in messages, with positive and uplifting affections outnumbering negative ones. This might be due to users' desire to present a positive image in the group, but could also be accounted for by the fact that living with diabetes is a long-term battle. Being positive and having a sense of humor could help patients maintain a good sense of self. The other possible explanation could be that users of this group perceived being positive as a social norm in this group.

Through the exchange of daily workouts, recipes, blood glucose readings, and the use of medications and insulin delivery methods, as well as the exchange of greetings and encouragements, users of the group cultivated a sense of companionship, as evidenced by some participants reporting

to the group with upcoming treatment and others following his/her treatment progress. Moreover, some participants appeared to influence peers in their medical (e.g., change of medications) and daily life (e.g., diets and exercises) decision-making processes by providing advice or being influenced by peers providing advice.

These three functions of a social network, social support, companionship, and social influence could lead to changes in one's thoughts and disease management behaviors. Previous studies suggest that an individual's Facebook network was not an effective venue for interacting about health, mainly due to users' concerns about self-image [12, 13]. We argue that it might also be because one's generic social network may fall short in providing informational support, exerting social influence, and creating a sense of companionship. Nevertheless, we recognize that, due to the method used in this study, we are not able to determine how the three social network functions influence users' health behavior and health outcomes and the nature of the influence.

In other diabetes groups on Facebook, advertisements or promotional messages accounted for about 27 % of the messages [30]. However, few such messages were posted in this group. This phenomenon, along with the overall positive atmosphere the group demonstrated, could be attributed to the community-building efforts made by its admin and a group of core members, who seemed to be "leaders" of the group [43]. Core teams were considered essential to the construction of certain communities, such as some small workgroups and technical sites [36], but their roles in online health communities were discussed less. Our focus on analyzing messages posted on the group's Wall also prevents us from gaining a deeper understanding of the functions of the core members in this group as well as their characteristics (e.g., when they were diagnosed). In future work, we intend to perform interviews with the admin and core members to understand their activities involved in managing and maintaining the group. To further advance the understanding of the social structure of the group, we shall also examine the behavior and motivations of users who participated in the group solely as friends or readers [43]. In future studies, it is also worthwhile to examine how users on other Facebook health groups interact with one another to improve the understanding of Facebook as a platform for health communication.

Conclusions

In this paper, we explored the basic characteristics of a large and active Facebook diabetes group, as well as user interactions that took place in the group. We found that the group consisted of diabetes patients and caregivers from all over the world. Users employed various tools, such as Google Translate and UK/USA Glucose Converter, to facilitate the communication. In addition to individual users, the participants of the group also included other diabetes groups on Facebook. Users' interactions with one another were structured by three elements: information, emotion, and community building. The interactions impacted the users by cultivating social support, including informational, emotional, and appraisal support, imposing social influences, and providing a sense of companionship. It was also observed that a small number of users in the group took responsibility and exerted great efforts to maintain a healthy environment in the group. In future studies, it is worthwhile to explore how users' interactions in the group influence group members' behaviors and health outcomes. In addition, future studies should examine topics that are important for community research in general and health community research in particular, including the influences of a blend of nationalities and cultures on group dynamics, the interactions between different groups, and the roles and activities of core group members. A deeper understanding of these subjects is necessary as the world becomes more and more connected.

Acknowledgments This work was supported in part by the Alumni Fellowship from the School of Information at the University of Texas at Austin.

Conflict of Interest The authors declare that they have no conflict of interest.

References

1. Bandura, A., *Social foundations of thought and action: a social cognitive theory*. Prentice-Hall, Englewood Cliffs, 1986.
2. Ajzen, I., and Fishbein, M., *Understanding attitudes and predicting social behavior*. Prentice-Hall, Englewood Cliffs, 1980.
3. House, J. S., *Work stress and social support*. Addison-Wesley Pub. Co, London, 1981.
4. DiMatteo, M. R., Social support and patient adherence to medical treatment: a meta-analysis. *Health Psychology: Official Journal of the Division of Health Psychology, American Psychological Association* 23(2):207–218, 2004.
5. Freyne, J., Berkovsky, S., Kimani, S., Baghaei, N., Brindal, E., Improving health information access through social networking. In:, 2010/10//2010. pp 334–339.
6. Baghaei, N., Kimani, S., Freyne, J., Brindal, E., Berkovsky, S., and Smith, G., Engaging families in lifestyle changes through social networking. *International Journal of Human-Computer Interaction* 27(10):971–990, 2011.
7. Hwang, K. O., Ottenbacher, A. J., Green, A. P., Cannon-Diehl, M. R., Richardson, O., Bernstam, E. V., and Thomas, E. J., Social support in an Internet weight loss community. *International Journal of Medical Informatics* 79(1):5–13, 2010.
8. Madden, M., Zickuhr, K., 65 % of online adults use social networking sites. 2011.http://pewinternet.org/~/media//Files/Reports/2011/PIP-SNS-Update-2011.pdf Accessed December 15 2012.
9. Bullas, J., 20 Interesting facts, figures and statistics revealed by facebook. 2012.http://www.jeffbullas.com/2012/04/30/20-interesting-facts-figures-and-statistics-revealed-by-facebook/ Accessed December 15 2012

10. Fox, S., The social life of health information. Pew Internet & American Life Project, 2011.
11. Morris, M. E., Consolvo, S., Munson, S., Patrick, K., Tsai, J., Kramer, A. D. I. Facebook for health: opportunities and challenges for driving behavior change. In: 2011. CHI EA '11. ACM, New York, NY, USA, pp 443–446, 2011.
12. Newman, M. W., Lauterbach, D., Munson, S. A., Resnick, P., Morris, M. E. It's not that I don't have problems, I'm just not putting them on facebook: Challenges and opportunities in using online social networks for health. In, 2011 CSCW '11. ACM, New York, NY, USA, pp 341–350, 2011.
13. Zhang, Y., College students' uses and perceptions of social networking sites for health and wellness information. *Information Research* 17(3):Paper 523, 2012.
14. Association, A. D., Economic costs of diabetes in the U.S. in 2007. *Diabetes Care* 3(13):596–615, 2008.
15. Anderson, R. M., and Funnell, M. M., Patient empowerment: reflections on the challenge of fostering the adoption of a new paradigm. *Patient Education and Counseling* 57(2):153–157, 2005.
16. Wright, K. B., and Bell, S. B., Health-related support groups on the internet: linking empirical findings to social support and computer-mediated communication theory. *Journal of Health Psychology* 8(1):39–54, 2003.
17. Eysenbach, G., Powell, J., Englesakis, M., Rizo, C., and Stern, A., Health related virtual communities and electronic support groups: systematic review of the effects of online peer to peer interactions. *BMJ: British Medical Journal* 328(7449), 2004.
18. Zhang, Y., Contextualizing consumer health information searching: an analysis of questions in a social Q&A community. In IHI '10. ACM, New York, NY, USA, pp 210–219, 2010. doi:10.1145/1882992.1883023
19. Maloney-Krichmar, D., and Preece, J., A multilevel analysis of sociability, usability, and community dynamics in an online health community. *ACM Trans Comput-Hum Interact* 12(2):201–232, 2005. doi:10.1145/1067860.1067864.
20. Setoyama, Y., Yamazaki, Y., and Namayama, K., Benefits of peer support in online Japanese breast cancer communities: differences between lurkers and posters. *Journal of Medical Internet Research* 13(4), 2011.
21. Shaw, B. R., Hawkins, R., McTavish, F., Pingree, S., and Gustafson, D. H., Effects of insightful disclosure within computer mediated support groups on women with breast cancer. *Health Communication* 19(2):133–142, 2006.
22. Bond, G. E., Burr, R. L., Wolf, F. M., and Feldt, K., The effects of a web-based intervention on psychosocial well-being among adults aged 60 and older with diabetes: a randomized trial. *The Diabetes Educator* 36(3):446–456, 2010.
23. Berger, M., Wagner, T. H., and Baker, L. C., Internet use and stigmatized illness (1982). *Social Science & Medicine* 61(8):1821–1827, 2005.
24. Davison, K. P., Pennebaker, J. W., and Dickerson, S. S., Who talks? The social psychology of illness support groups. *The American Psychologist* 55(2):205–217, 2000.
25. Boyd, D., and Ellison, N., Social network sites: definition, history, and scholarship. *Journal of Computer-Mediated Communication* 13:210–230, 2008.
26. Rainie, L., Smith, A., Social networking sites and politics. 2012. http://pewinternet.org/~/media//Files/Reports/2012/PIP_SNS_and_politics.pdf. Accessed December 15 2012
27. Rau, P.-L. P., Gao, Q., and Ding, Y., Relationship between the level of intimacy and lurking in online social network services. *Computers in Human Behavior* 24(6):2757–2770, 2008.
28. Holt, C., Emerging technologies: Web 2.0. *Health Information Management Journal* 40(1):33–35, 2011.
29. Scanfeld, D., Scanfeld, V., and Larson, E. L., Dissemination of health information through social networks: Twitter and antibiotics. *American Journal of Infection Control* 38:182–188, 2010.
30. Greene, J. A., Choudhry, N. K., Kilabuk, E., and Shrank, W. H., Online social networking by patients with diabetes: a qualitative evaluation of communication with Facebook. *Journal of General Internal Medicine* 26(3):287–292, 2011.
31. Shaw, R. J., and Johnson, C. M., Health information seeking and social media use on the Internet among people with diabetes. *Online Journal of Public Health Informatics* 3(1):1–9, 2011.
32. Shrank, W. H., Choudhry, N. K., Swanton, K., Jain, S., Greene, J. A., Harlam, B., and Patel, K. P., Variations in structure and content of online social networks for patients with diabetes. *Archives of Internal Medicine* 171(17):1589–91, 2011.
33. Weitzman, E. R., Cole, E., Kaci, L., and Mandl, K. D., Social but safe? Quality and safety of diabetes-related online social networks. *Journal of the American Medical Informatics Association* 18(3):292–297, 2011.
34. Zhang, Y., and Wildemuth, B. M., Qualitative analysis of content. In: Wildemuth, B. (Ed.), *Applications of social research methods to questions in information and library science*. Libraries Unlimited, Westport, pp. 308–319, 2009.
35. Lee, F., Vogel, D., Limayem, M. Virtual community informatics: A review and research agenda. Journal of Information Technology Theory and Application (JITTA) 5 (1): Article 5, 2003
36. Kow, Y. M., Nardi, B. Forget online communities?: revisit cooperative work! In: 2011 CSCW '11. ACM, New York, NY, USA, pp 351–354, 2011.
37. Klemm, P., Reppert, K., and Visich, L., A nontraditional cancer support group. The Internet. *Computers in Nursing* 16(1):31–36, 1998.
38. Preece, J., Empathic communities: reaching out across the Web. *Interactions* 5(2):32–43, 1998.
39. Ahmed, O. H., Sullivan, S., Schneiders, A. G., and McCrory, P., iSupport: do social networking sites have a role to play in concussion awareness? *Disability and Rehabilitation* 32(22):1877–1883, 2010.
40. Granovetter, M. S., The strength of weak ties: a network theory revisted. *Sociological Theory* 1:201–233, 1983.
41. Wellman, B., and Wortley, S., Different strokes from different folks: community ties and social support. *The American Journal of Sociology* 96(3):558–588, 1990.
42. Campbell, H. S., Phaneuf, M. R., and Deane, K., Cancer peer support programs—do they work? *Patient Education and Counseling* 55(1):3–15, 2004.
43. Shneiderman, B., Preece, J., and Pirolli, P., Realizing the value of social media requires innovative computing research. *Communications of the ACM* 54(9):34–37, 2011.