

## PDF hosted at the Radboud Repository of the Radboud University Nijmegen

The following full text is a publisher's version.

For additional information about this publication click this link.

<http://hdl.handle.net/2066/149373>

Please be advised that this information was generated on 2021-06-18 and may be subject to change.

# Virtual Support Communities and Psychological Well-Being: The Role of Optimistic and Pessimistic Social Comparison Strategies

Anika Batenburg

Department of Communication and Information Studies - Centre for Language Studies, Radboud University, Erasmusplein 1, 6525 HT, Nijmegen, The Netherlands

Enny Das

Department of Communication and Information Studies - Centre for Language Studies, Radboud University, Erasmusplein 1, 6525 HT, Nijmegen, The Netherlands

*Do the beneficial or detrimental effects of CMC activity depend on the specific social comparison strategy individuals use? The present study aimed to answer this question by examining social comparison strategies, different measures of online activity within the community, and psychological well-being of users of online breast cancer support communities. Results showed that the relationship between online activity (i.e., length of visits and frequency of posts) and psychological well-being (i.e., breast cancer related concerns and depression) was determined by users' pessimistic social comparison strategy; downward identification influenced especially highly active users. Findings suggest that active CMC users should be careful not to become entrapped by negative social comparison processes.*

**Keywords:** Support, Online Communities, Online Forums, Health, Patients, Social Science.

doi:10.1111/jcc4.12131

## Introduction

There is an ongoing debate on the Internet's potential to create or diminish community, and the beneficial and detrimental effects of online communities. On the one hand, literature on online social networks suggests that many people are drawn to online support communities, and that empowering and social support processes take place within online social networks (Rodgers & Chen, 2005; Van Uden-Kraan, Drossaert, Taal, Shaw, & van de Laar, 2008a; Walther & Boyd, 2002), with potential beneficial effects on psychological well-being. On the other hand, other lines of research show that using online social platforms could also have detrimental effects. For example, descriptive studies on online health communities show that some users have difficulty dealing with stories about negative aspects of

---

Editorial Record: First manuscript received on July 21, 2014. Initial Action Editor: Joseph B. Walther. Revision received on February 11, 2015. Accepted by S. Shyam Sundar on May 13, 2015. Final manuscript received on May 29, 2015. First published online on August 24, 2015.

Correction made after online publication August 24, 2015: Editorial Record has been updated.

the disease (Barak, Boniel-Nissim, & Suler, 2008; Van Uden-Kraan et al., 2008a; Vilhauer, 2009), and sometimes even withdraw from the online community for that reason (Sandaunet, 2008a; Sandaunet, 2008b). Other study examples on Social Network Sites (SNS) show that Facebook use can be related to negative self-perceptions, negative mood, depression (Haferkamp & Krämer, 2011), and a decline in life satisfaction (Kross et al., 2013), and that Facebook users who consume greater levels of content report reduced bridging and bonding social capital and increased loneliness (Burke, Marlow, & Lento, 2010).

Social comparisons seem to play an important role in these effects; online platforms that facilitate social connections have the potential to stimulate the human tendency to compare oneself to others, and this can affect psychological well-being (Fox & Moreland, 2015). Although some studies on SNS have touched upon the subject of negative social comparisons, systematic research on the general importance of social comparison strategies across different online communities is lacking. A first goal of the present research was therefore to assess the role of social comparison processes (i.e., how users tend to compare their own situation to the situation of online peers) in the relationship between online activity and psychological well-being in the context of a support community for cancer patients. The overall question that drives this research is: Do the beneficial or detrimental effects of online activity depend on the specific social comparison strategy individuals use?

We also add to previous findings by zooming in on different types of online activity. Previous research suggests differences between lurkers (i.e., individuals who do not post messages) and posters (i.e., individuals who post messages), but little is known about how specific types of online activity influence members' psychological well-being. Finally, we examine whether level of activity in online support communities contributes to individuals' well-being *on top of* other factors that influence well-being outside the online environment, such as perceived social support from friends and family. A limitation of the majority of studies on computer-mediated communication is that they often focus on the online environment without looking at relevant (perceptual, behavioral, and health-related) covariates from the offline world. Since there is no online world without an offline world, our aim is to test if participating within a virtual support community has an added value to members' psychological well-being next to offline determinants of well-being.

### **Virtual Support Communities and Psychological Well-being**

Although online communities exist on many different topics and for various purposes, in the current study we focus on online breast cancer communities because connecting with similar others appears especially attractive to individuals who are concerned or feel stigmatized. For example, research has shown that individuals dealing with AIDS, alcoholism, cancer, depression, and diabetes are highly motivated to seek information and support from similar others, both in the on- and offline world (Davison, Pennebaker, & Dickerson, 2000; Nagler et al., 2010). Most online patient communities are set-up by (ex)patients, and organized as a bulletin board. Because online conversations are asynchronous, users are not obliged to be part of the dialogue; they can simply read stored conversations from others if they do not feel like talking (Walther & Boyd, 2002). Previous research has shown that about 50% of the members of health-related online communities are lurkers, i.e., do not post messages (46 percent: Preece, Nonnecke, & Andrews, 2004; 51.4 percent: Setoyama, Yamazaki, & Namayama, 2011). Members are free in how often and for how long they visit the online platform, and if and how often they post messages. However, little is known about how different levels of online behavior (i.e., online activity) influence members' psychological well-being.

A scarce number of longitudinal studies suggest positive psychological effects, however in these studies online behavior was not extensively measured (Lieberman & Goldstein, 2005; Lieberman &

Goldstein, 2006; Lieberman, 2007). One study showed that a group of cancer patients who started participating in an online support community experienced an increase in psychological well-being over time (Lieberman & Goldstein, 2005). However, it remains unclear if patients felt better due to online participation (i.e., lurking, posting, or both), or if these improvements occurred independent of online peer support (e.g., just because time passed after the moment of diagnosis). Another study revealed that specific online word use within the posts was related to a positive change in well-being, i.e., words indicating anger, sadness, anxiety (Lieberman & Goldstein, 2006), and words indicating insightful disclosure (Lieberman, 2007). Again, however, it remains unclear if online word use caused changes in well-being, or if word use was just a reflection of patients' improvement in well-being. Research assessing the relationship between specific types of online activity (e.g., passive, active) and community member's psychological well-being is needed to provide a definitive answer to the question whether participation in virtual support communities contributes to wellbeing.

Although lurkers seem to benefit from just reading conversations of others (especially regarding information-related benefits; Setoyama et al., 2011; Van Uden-Kraan, Drossaert, Taal, Seydel, & van de Laar, 2008b), posters may experience additional psychological benefits because they are more engaged within the community. For example, a survey study among cancer patients showed that posters encounter more psychologically promising processes than lurkers, such as expressing emotions, helping other patients, and receiving emotional support (Setoyama et al., 2011). Another descriptive study revealed that lurkers perceived the empowering processes 'exchanging information' and 'finding recognition' as less present than posters, and posters experienced a greater improvement in their social well-being compared to lurkers (Van Uden-Kraan et al., 2008b). Furthermore, a study among caregiver health communities showed that whereas active posting behavior decreased the negative effect of caregiver strain on well-being, online presence had no influence on this relationship (Tanis, Das, & Fortgens, 2011).

Because members' level of engagement seems to matter to experience the potential benefits of online peer support, in the current study we expect that members who participate more actively (i.e., visit the community more often, stay longer online per visit, post more messages, and are more engaged in contributing to the online community than average) also report a higher level of psychological well-being than members who are less active online (*Hypothesis 1*).

### **Social Comparison Strategies and Computer-Mediated Communication**

Two types of social comparison exist, determined by their direction: *Downward social comparisons* concern comparisons with others doing worse, and *upward social comparisons* refer to comparisons with others better off. The Contrast/Identification Model of Buunk, Collins, Taylor, VanYperen, and Dakof (1990) proposes that psychological effects of comparing the self to others doing better or worse depend on the conclusion one draws from this comparison. For example, when comparing oneself to someone doing better, some individuals tend to become optimistic and find hope from others in a better situation (i.e., upward identification), while others get pessimistic because they become frustrated (i.e., upward contrast). Likewise, by comparing the self to others worse off, some individuals get more optimistic because they feel lucky to be in a better position (i.e., downward contrast), while others are more pessimistic because they tend to become anxious to be in the same situation one day (i.e., downward identification; Buunk et al., 1990; Dibb & Yardley, 2006).

Although the social comparison literature shows that the way individuals relate their personal situation to that of others can influence one's psychological well-being positively or negatively, little is known about the role of these individual social comparison strategies in virtual support communities. Some evidence for the presence of social comparisons in online environments comes from studies on Social

Network Sites (SNS). Although SNS are not exactly the same as online communities and most SNS studies cover healthy individuals, these studies have shown that SNS elicit social comparison behavior that, in turn, is related to psychological well-being. For example, due to constant social comparisons some Facebook users experience jealousy, anxiety and other negative emotions (Fox & Moreland, 2015). Tandoc, Ferrucci, and Duffy (2015) showed that the relationship between surveillance use of Facebook and depression is mediated by Facebook envy, and an experiment of Haferkamp and Krämer (2011) indicated that when looking at SNS profiles, comparing oneself to others who have less career success or are physically less attractive showed positive effects on self-perceptions, and comparing oneself to physically less attractive others showed a positive effect on mood. Thus, online platforms that facilitate social connections have the potential to stimulate the human tendency to compare oneself to others, and this might affect users' psychological well-being.

If we look specifically at illness-related social comparisons, most studies focus on comparison strategies amongst cancer patients in *offline* situations. For example, a study on women with breast cancer participating in an offline support group showed that upward identification (i.e., gaining hope from others doing better) was positively related to posttraumatic growth (Morris, Campbell, Dwyer, Dunn, & Chambers, 2011). Also another study in an offline setting, showed that upward identification was negatively related to depression (Legg, Occhipinti, Ferguson, Dunn, & Chambers, 2011). One study assessed social comparisons in the context of reading about experiences of other patients with Ménière's disease in a support group magazine, and found positive associations between optimistic social comparisons (both upward identification and downward contrast) and quality of life, and negative associations between pessimistic comparisons (both upward contrast and downward identification) and quality of life (Dibb & Yardley, 2006).

Social comparison processes are also likely to be present in online health communities. Most people who surround a patient in daily life (i.e., family and friends) are not ill. Even though they try to support this person the best they can, they might not always understand the patient's situation, thoughts and feelings. Consequently, patients turn online to look for others in the same situation. Descriptive studies have shown that one of the reasons for patients to turn to an online community is to find recognition and to compare their own situation to that of others (Van Uden-Kraan et al., 2008a). As a result, it is reasonable to expect that social comparisons play an important role within an online community as well. Furthermore, because not everyone's interpretation of the comparison is equal (i.e., some draw negative and some positive conclusions), it is expected that one's personal social comparison strategy might determine the psychological effects of participating within an online community.

The presumption that individual differences in dealing with illness moderate the effects of online activity level on well-being is underscored by findings from different research lines. First, a recent longitudinal study showed that participating intensely within an online support community was only beneficial for members who did not have the natural tendency to actively approach their emotions. Members who approached their emotions showed the highest level of well-being overall, but experienced no beneficial effects of active online participation over time (Batenburg & Das, 2014). Second, in the context of social comparisons, a recent study on Facebook use showed that heavy Facebook users experienced stronger feelings of envy than light users (Tandoc et al., 2015), probably because they are exposed to more points of comparison (i.e., more posts of friends to compare with). Third, a study comparing different *offline* patient interventions showed that breast cancer patients in a peer-discussion group scored higher on downward identification (i.e., become anxious to be in the same situation one day) compared with patients in the education (interactions between patients were inhibited) or control group (Helgeson, Cohen, Schulz, & Yasko, 2001). Together these findings suggest that the more someone is engaged in conversation with other patients, the greater the opportunity to compare oneself to other patients. We expect this to happen in a virtual support community as well.

Specifically, we expect to find a different relationship between online activity and psychological well-being due to differences in members' personal comparison strategies. We hypothesize that users who score higher on online pessimistic social comparison strategies (i.e., downward identification and upward contrast) and who participate actively online report lower psychological well-being than pessimistic members who participate less actively online. Likewise, users with a high score on optimistic social comparison strategies (i.e., upward identification and downward contrast) are expected to report higher psychological well-being when they are more active online, compared to optimistic members who are less active within the community (*Hypothesis 2*).

## Method

### Procedure and Participants

We searched the Internet with Google to identify all Dutch online 24-hour available peer-led message boards on breast cancer. Criteria for inclusion were that (1) the website was in the Dutch language, (2) the website was designed as a 24-hour available message board, and (3) the discussion board was still active (new messages were posted within the past month). Seven active Dutch breast cancer peer support websites were identified. With approval of the website owners, we posted a link on these message boards, and asked patients to participate in an online survey about breast cancer and media use. A sample of 134 Dutch women diagnosed with breast cancer filled out the questionnaire. A number of 114 participants stated that they were visiting the online support community; the remaining 20 patients reported they were not. Since these patients claimed they did not visit the community, they also did not fill out our four questions assessing their online behavior. We therefore had to exclude them from data analyses.

This survey was part of a more extensive project to reveal the psychological effects of virtual support communities among breast cancer patients. Specifically, the aim of this project is to uncover different moderators and long-term psychological effects of online participation. The research was carried out in line with APA ethics guidelines (APA Council of Representatives, 2010), and complies with EU legislation ("Protection of personal data," 2012), and the Dutch legislation on data protection ("Wet bescherming persoonsgegevens," 2013).

### Measurements

#### *Independent variables*

Four questions assessed users' *online behavior in the last 4 weeks* (cf. Van Uden-Kraan, Drossaert, Taal, Seydel, & van de Laar, 2009). We asked how often patients visited the online community in the last 4 weeks (7-point scale ranging from less than once a month to multiple times per day), the average duration of these visits (less than 10 minutes; 10 to 30 minutes; 30 minutes to one hour; more than one hour), how engaged they were in the last four weeks (I only read posts from others; I reacted on (a) post(s) of someone else; I started a new topic or asked a question; I both started a new topic or asked a question AND I reacted on (a) post(s) of another), and how often they posted messages online in the last 4 weeks (answer categories: none; one per week or less; multiple posts per week, but not every day; every day one post or more). Since one of our goals was to reveal which online behavior is particularly related to members' psychological well-being, we treated the four items separately in our analyses.

*Social comparison strategies* were measured by four different indices all consisting three items, assessed on a 5-point scale (Van der Zee, Buunk, Sanderman, Botke, & van den Bergh, 2000). Items

were adjusted to the online community (“When I read about the experiences from others on [name of website], I ...”). Two indices measured pessimistic comparisons; *downward identification*, (e.g., “... I fear that my future will be similar”; Cronbach’s  $\alpha = .95$ ) and *upward contrast* (e.g., “... I feel frustrated about my own situation”; Cronbach’s  $\alpha = .86$ ). Two indices assessed optimistic comparisons; *upward identification* (e.g., “... I realize it is possible to improve”; Cronbach’s  $\alpha = .87$ ) and *downward contrast* (e.g., “... I realize how well I am doing”; Cronbach’s  $\alpha = .77$ ).

### *Dependent variables*

Three indices measured psychological well-being. First we measured *depression* with 10 items on a 5-point scale (CES-D10; e.g., “My sleep was restless”; Irwin, Artin, & Oxman, 1999). The index was internally consistent (Cronbach’s  $\alpha = .81$ ) but was positively skewed. A log-transformation was performed to meet the assumptions of multiple regression analysis. Higher scores indicated more depressive thoughts. *Breast cancer related concerns* (Profile of Concerns about Breast cancer; Spencer et al., 1999) were measured with an index of 28 items assessed on a 5-point scale. The index showed consistency, Cronbach’s  $\alpha = .92$  (e.g., “As you think about your illness, how much are you concerned that chemotherapy or radiation therapy will damage your body in some way?”). Higher scores indicated more concerns. *Emotional well-being* was measured according six items from the FACT-B (Brady et al., 1997) on a 5-point scale (e.g., “I’m proud of how I am coping with my illness”) and showed scale consistency, Cronbach’s  $\alpha = .86$ . Higher scores indicated a better emotional well-being.

### *Control variables*

To reveal if online participation would add to patients’ psychological well-being in addition to their current offline situation, we assessed basic demographics, illness characteristics and “offline” perceived social support. We measured participants’ age, education level, working status (yes/no), if they were under treatment at the moment (yes/no), the amount of medical appointments concerning the breast cancer in the last 3 months, illness stage, offline social support, and if patients received any professional psychological help regarding their illness (yes/no); factors that are considered as important covariates of patient well-being (Batenburg & Das, 2014; Cunningham & Barbee, 2000; Wen, McTavish, Kreps, Wise, & Gustafson, 2011). *Illness stage* was measured by the standard four phases in breast cancer (Oldenburg, Vrancken Peeters, & van Bohemen, 2009). Six items from the FACT-B (Brady et al., 1997) measured *offline social support* on a 5-point scale. Items referring to friends were adjusted into items that clearly referred to their offline friends (Cronbach’s  $\alpha = .80$ ).

### **Statistical analyses**

We tested different models with regression analysis. All independent variables (i.e., the online behavior items and social comparison strategies) were standardized into z-scores to compute interaction-terms. For each psychological well-being indicator (i.e., depression, emotional well-being, and breast cancer-related concerns), we ran separate models that included one type of the four online behavior indicators, all four social comparison strategies, and the interaction terms between this online behavior item and the social comparison strategies (model 1). To assess if the main and interaction effects of our independent variables were still significant on top of offline well-being modifiers, we added covariates that were significantly correlated to the dependent variable, i.e., psychological well-being measures (model 2). We only reported the regression models that showed significant interaction effects of online behavior and social comparison strategies. Other statistical results are reported within the text.

## Results

### Sample Characteristics

The mean age of participants was 49 years (range: 23–69), most of them were well educated (64.9% finished tertiary education), and 54.4 percent was still working. Most of the participants were currently free of cancer cells (61.4%); a little more than half (52.6%) of the participants was still under treatment. On average, participants had three to 4 medical appointments regarding their breast cancer in the last 3 months, and almost 38 percent received illness related psychological counseling. Most members visited the online community multiple times per week or every day (53.6%). The majority of patients did not post at all (38.6%) or posted only one message per week or less (30.7%). Almost a third of participants only read posts from peers (29.8%), while others also reacted on messages from peers and/or started new topics of discussion by themselves (70.2%). More than a third (36%) of the members was online for less than 10 minutes per visit, while 52.6% was online for 10 to 30 minutes on average, and only 2.6% visited the online platform for more than an hour in the last 4 weeks.

### Online Activity, Social Comparison Strategies and Well-Being

Bivariate correlations showed which covariates (i.e., offline factors) were related to psychological well-being, and the relations between independent and dependent variables. Both average amount of visits ( $r = .21, p < .05$ ) and average amount of posts ( $r = .25, p < .01$ ) were positively correlated with upward identification (i.e., finding hope).

The four items measuring online activity were not directly related to psychological well-being, except for the average length of visits ( $r = -.19, p < .05$ ). Online downward identification was negatively related to psychological well-being (emotional well-being,  $r = -.56, p < .01$ ; breast cancer-related concerns,  $r = .43, p < .01$ ; depression,  $r = .35, p < .01$ ). Also online upward contrast was related to emotional well-being ( $r = -.62, p < .01$ ), breast cancer-related concerns ( $r = .51, p < .01$ ), and depression ( $r = .38, p < .05$ ). Upward identification was not related to psychological well-being. Downward contrast was positively related to emotional well-being ( $r = .19, p < .05$ ).

Regarding covariates, education level was correlated with all well-being measures; the higher participants' education, the better their psychological well-being (emotional well-being,  $r = .21, p < .05$ ; breast cancer-related concerns,  $r = -.26, p < .01$ ; depression,  $r = -.25, p < .01$ ). Offline social support was significantly associated with all three well-being measures (emotional well-being,  $r = .34, p < .01$ ; breast cancer-related concerns,  $r = -.43, p < .01$ ; depression,  $r = -.38, p < .01$ ), and with downward identification ( $r = -.31, p < .01$ ), downward contrast ( $r = .20, p < .05$ ) and upward contrast ( $r = -.33, p < .01$ ). The less patients felt supported by their friends and family, the worse their psychological well-being, the higher they scored on both pessimistic social comparison strategies, and the lower they scored on downward contrast (i.e., an optimistic strategy). Illness stage correlated significantly with emotional well-being ( $r = -.22, p < .05$ ): when the illness was further progressed patients reported lower emotional well-being. Moreover, psychological help was associated with all well-being measures (emotional well-being,  $r = -.30, p < .01$ ; breast cancer-related concerns,  $r = .30, p < .01$ ; depression,  $r = .33, p < .01$ ); patients who received psychological help from a professional during the period of illness reported lower psychological well-being.

### Hypotheses Testing

#### *Amount of posts*

Regression analyses showed no relationship between the average amount of posts in the last 4 weeks and depression, emotional well-being, or breast cancer-related concerns. Online upward contrast



**Table 1** Hierarchical Regression Results for the Effects of Amount of Posts and Online Social Comparison Strategies on Breast Cancer-Related Concerns,  $N = 112^{\dagger}$ 

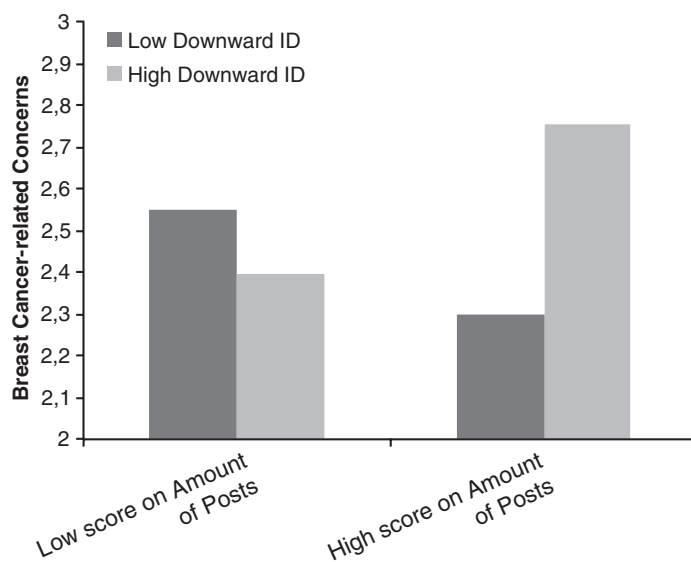
Variable	Model 1 (without covariates)			Model 2 (with covariates)		
	<i>b</i> ( <i>SE</i> )	$\beta$	<i>P</i>	<i>b</i> ( <i>SE</i> )	$\beta$	<i>P</i>
<i>Main effects</i>						
(A) Amount of posts	0.00 (.06)	0.00	.978	0.03 (.05)	0.04	.620
(B) Downward identification	<b>0.17 (.06)</b>	<b>0.26</b>	<b>.005</b>	0.08 (.06)	0.12	.180
(C) Downward contrast	-0.05 (.05)	-0.08	.344	-0.01 (.05)	-0.02	.775
(D) Upward identification	0.00 (.06)	0.00	.970	-0.01 (.05)	-0.01	.873
(E) Upward contrast	<b>0.23 (.06)</b>	<b>.368</b>	<b>&lt;.001</b>	<b>0.20 (.05)</b>	<b>0.32</b>	<b>&lt;.001</b>
<i>Interaction effects</i>						
A x B	<b>0.14 (.06)</b>	<b>0.22</b>	<b>.025</b>	<b>0.15 (.06)</b>	<b>0.23</b>	<b>.011</b>
A x C	0.07 (.05)	0.12	.192	0.06 (.05)	0.10	.242
A x D	0.00 (.06)	0.00	.993	-0.02 (.05)	-0.04	.642
A x E	-0.02 (.06)	-0.04	.682	-0.06 (.05)	-0.11	.230
<i>Covariates</i>						
Education				-0.07 (.05)	-0.11	.192
Working status*				<b>-0.22 (.10)</b>	<b>-0.17</b>	<b>.037</b>
Psychological help*				<b>0.26 (.10)</b>	<b>0.20</b>	<b>.010</b>
Offline social support				<b>-0.15 (.06)</b>	<b>-0.23</b>	<b>.006</b>
$R^2$	.36			.50		
$R^2$ change ( <i>P</i> )				.14 (<.001)		
Adjusted $R^2$	.30			.43		

Notes. \* Coded 0 = no, 1 = yes. <sup>†</sup>Two respondents are missing, because of one missing value for 'working status' and one missing value for 'education level'

and downward identification significantly predicted breast cancer-related concerns (upward contrast:  $b = .230$ ,  $SE = .056$ ,  $\beta = .368$ ,  $p < .001$ ; downward identification:  $b = .168$ ,  $SE = .059$ ,  $\beta = .259$ ,  $p = .005$ ), depression (upward contrast:  $b = .032$ ,  $SE = .012$ ,  $\beta = .258$ ,  $p = .011$ ) and emotional well-being (upward contrast:  $b = -.407$ ,  $SE = .068$ ,  $\beta = -.489$ ,  $p < .001$ ; downward identification:  $b = -.259$ ,  $SE = .076$ ,  $\beta = -.283$ ,  $p = .001$ ). No relationship between upward identification or downward contrast (i.e., optimistic comparison strategies) and well-being measures were found. However, an interaction between average amount of posts and downward identification predicted breast cancer-related concerns (see Table 1).

Users who posted more frequently in the last 4 weeks (+1 SD) and who tended to identify with peers doing worse (+1 SD) reported more breast cancer-related concerns than users who posted equally frequently (+1 SD) and tended to identify less (-1 SD) with peers worse off. For users who posted less frequently (-1 SD), downward identification was not associated with the amount of breast cancer-related concerns (Figure 1).

When the model included the covariates (i.e., offline factors that were significantly correlated with the well-being measures), the relationships between upward contrast and breast cancer-related concerns ( $b = .203$ ,  $SE = .053$ ,  $\beta = .324$ ,  $p < .001$ ), depression ( $b = .025$ ,  $SE = .012$ ,  $\beta = .205$ ,  $p = .035$ ), and emotional well-being ( $b = -.393$ ,  $SE = .069$ ,  $\beta = -.472$ ,  $p < .001$ ) remained significant. Also the relationship



**Figure 1** Interaction effect of Amount of Posts and Downward Identification on Breast Cancer Related Concerns *Note.* ‘low’ means one standard deviations below the mean, and ‘high’ one standard deviation above the mean

between downward identification and emotional well-being remained significant ( $b = -.188$ ,  $SE = .077$ ,  $\beta = -.205$ ,  $p = .017$ ). Additionally, the interaction between average amount of posts and downward identification on breast cancer related concerns remained significant (Table 1).

#### *Length of visits*

Results showed no significant direct relationship between average length of visits in the last 4 weeks and depression, emotional well-being, and breast cancer-related concerns. However, online downward identification and upward contrast (i.e., both pessimistic comparison strategies) were positively related to breast cancer-related concerns (downward identification:  $b = .194$ ,  $SE = .059$ ,  $\beta = .299$ ,  $p = .001$ ; upward contrast:  $b = .213$ ,  $SE = .058$ ,  $\beta = .339$ ,  $p < .001$ ), depression (downward identification:  $b = .029$ ,  $SE = .013$ ,  $\beta = .223$ ,  $p = .026$ ; upward contrast:  $b = .025$ ,  $SE = .013$ ,  $\beta = .200$ ,  $p = .051$ ), and negatively related to emotional well-being (downward identification:  $b = -.257$ ,  $SE = .074$ ,  $\beta = -.280$ ,  $p = .001$ ; upward contrast:  $b = -.385$ ,  $SE = .069$ ,  $\beta = -.462$ ,  $p < .001$ ). No relationship between online upward identification or downward contrast (i.e., optimistic comparison strategies) and well-being measures were found. Furthermore, interactions between length of visits and downward identification on breast cancer-related concerns and depression were found (see Table 2).

Users who stayed longer online per visit (+1 SD) and who tended to identify with peers doing worse (+1 SD) reported more breast cancer-related concerns than members who stayed for an equally period of time per visit but who identified less (-1 SD) with peers worse off. For users who visited the community shorter (-1 SD), downward identification was not associated with the amount of breast cancer-related concerns. The same pattern was found for depression. Users with a high score on the average length of visits (+1 SD) reported more depressive feelings when they scored high (+1 SD) on downward identification than users who stayed long per visit (+1 SD) but scored lower on downward identification

**Table 2** Hierarchical Regression Results for the Effects of Length of Visits and Online Social Comparison Strategies on Breast Cancer-Related Concerns and Depression, N = 112<sup>†</sup>

Variable	Breast Cancer-related Concerns						Depression					
	Model 1 (without covariates)			Model 2 (with covariates)			Model 1 (without covariates)			Model 2 (with covariates)		
	b (SE)	β	P	b (SE)	β	P	b (SE)	β	P	b (SE)	β	P
<i>Main effects</i>												
(A) Length of visits	-0.03 (.06)	-0.04	.646	-0.01 (.05)	-0.02	.803	0.01 (.01)	0.08	.375	0.02 (.01)	0.12	.179
(B) Downward identification	<b>0.19 (.06)</b>	<b>0.30</b>	<b>.001</b>	0.10 (.06)	0.16	.080	<b>0.03 (.01)</b>	<b>0.22</b>	<b>.026</b>	0.01 (.01)	0.09	.359
(C) Downward contrast	-0.06 (.06)	-0.09	.303	-0.03 (.05)	-0.05	.554	-0.01 (.01)	-0.08	.367	-0.01 (.01)	-0.06	.508
(D) Upward identification	0.02 (.05)	-0.03	.755	-0.02 (.05)	-0.02	.771	-0.02 (.01)	-0.12	.202	-0.01 (.01)	-0.11	.214
(E) Upward contrast	<b>0.21 (.06)</b>	<b>0.34</b>	<b>&lt;.001</b>	<b>0.20 (.06)</b>	<b>0.32</b>	<b>.001</b>	0.03 (.01)	0.20	.051	0.02 (.01)	0.15	.126
<i>Interaction effects</i>												
A x B	<b>0.14 (.06)</b>	<b>0.21</b>	<b>.033</b>	0.08 (.06)	0.13	.177	<b>0.03 (.01)</b>	<b>0.23</b>	<b>.038</b>	0.02 (.01)	0.14	.196
A x C	0.12 (.06)	0.21	.057	0.08 (.06)	0.15	.158	0.02 (.01)	0.18	.135	0.02 (.01)	0.13	.254
A x D	0.01 (.05)	0.03	.813	0.01 (.05)	0.02	.862	-0.01 (.01)	-0.07	.528	-0.01 (.01)	-0.09	.425
A x E	-0.06 (.05)	-0.11	.273	-0.03 (.05)	-0.05	.600	-0.02 (.01)	-0.14	.187	-0.01 (.01)	-0.09	.357
<i>Covariates</i>												
Education				-0.06 (.05)	-0.09	.291				-0.02 (.01)	-0.16	.077
Working status*				<b>-0.24 (.11)</b>	<b>-0.19</b>	<b>.025</b>						
Psychological help*				<b>0.28 (.10)</b>	<b>0.21</b>	<b>.007</b>				<b>0.07 (.02)</b>	<b>0.25</b>	<b>.003</b>
Offline social support				<b>-0.11 (.06)</b>	<b>-0.17</b>	<b>.048</b>				<b>-0.03 (.01)</b>	<b>-0.20</b>	<b>.032</b>
R <sup>2</sup>	.36			.48						.24	.36	
R <sup>2</sup> change (P)				.12 (.001)						.12 (.001)		
Adjusted R <sup>2</sup>	.31			.41						.18	.28	

Notes. \*Coded 0 = no, 1 = yes. †Two respondents are missing, because of one missing value for 'working status' and one missing value for 'education level'.

(-1 SD). For users with a low score on the average length of visits, downward identification was not associated with depression.

When covariates (i.e., “offline” factors) were added to the model (model 2), the relationship between upward contrast, breast cancer-related concerns ( $b = .199$ ,  $SE = .056$ ,  $\beta = .318$ ,  $p = .001$ ) and emotional well-being ( $b = -.380$ ,  $SE = .069$ ,  $\beta = -.457$ ,  $p < .001$ ) remained significant. Additionally, the relationship between downward identification and emotional well-being was still significant ( $b = -.176$ ,  $SE = .076$ ,  $\beta = -.192$ ,  $p = .023$ ). The interactions between length of visits and downward identification on breast cancer-related concerns and depression became nonsignificant (see Table 2).

The other online behavior measures (online engagement and frequency of visits) showed no significant results: No additional relationships between online engagement or frequency of visits and well-being, or interactions between online engagement, frequency visits, and social comparison strategies were found. The previously found relationships between online social comparison strategies and emotional well-being, breast cancer-related concerns, and depression remained significant across all regression models.

## Discussion

The present study examined the role of different social comparison strategies in the relationship between online activity and psychological well-being in the context of a support community for cancer patients. We expected that users who participate more actively (i.e., visit the community more often, stay longer online per visit, post more messages, and are more engaged in contributing to the online community than average) would report a higher level of psychological well-being than members who are less active online (*Hypothesis 1*). We further hypothesized that especially active users would suffer from the use of online pessimistic social comparison strategies (i.e., downward identification and upward contrast), and benefit from optimistic social comparison strategies (i.e., upward identification and downward contrast) in terms of psychological well-being (*Hypothesis 2*).

Findings partially support the hypotheses. Online activity was not directly related to well-being, but a direct relation between online social comparison strategies and well-being was found (cf. *Hypothesis 1*). Furthermore, interactions of online activity and social comparison strategies on well-being were found (cf. *Hypothesis 2*). Specifically, downward identification, i.e., identifying with online peers who are worse off, and upward contrast, i.e., dis-identifying with online peers who are better off, were related to lower levels of psychological well-being. Furthermore, downward identification was positively related to depression and breast cancer-related concerns especially for community members with long average visits to the online community. Finally, identifying with people who are worse off was positively related to depression for participants with relatively high numbers of online posts. Being frequently confronted with negative stories from others may frighten patients and increase more concerns regarding the illness. If this is the case, users may eventually withdraw from the online environment. Alternatively, patients with concerns might be more active online, and because of their concerns they might identify with peers worse off, whereas highly active patients with less concerns might identify less with peers worse off. Longitudinal research is needed to confirm causality.

Although our findings showed an initial positive correlation between the two optimistic comparison processes and psychological well-being, optimistic social comparisons did not predict psychological well-being in the regression analyses, nor did they interact with online activity. Furthermore, we found a positive relationship between the intensity of online participation and upward identification (i.e., identifying with patients doing better). None of the other comparison mechanisms were related to online activity. This suggests that although online active patients identify with positive stories, reading such

stories does not necessarily affect psychological well-being. One possible explanation is that negative stories are more abundant online than positive stories. A qualitative case study in which one patient's online activity was monitored during the period of illness showed that this patient especially turned to the online group when she experienced difficulties regarding the breast cancer (Wen et al., 2011). Although this case study is not generalizable to other patients, it points to the possibility that patients mainly need support from peers when they experience a distress-inducing event, and therefore mainly write about negative experiences.

Alternatively, the impact of negative comparisons may override the effects of positive comparisons (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). Patients may identify with survivor stories or feel lucky doing better than others, but this might not immediately affect psychological well-being. Such comparisons might however serve other goals that affect well-being over time. For example, patients in the midst of the disease may learn from survivors how to cope with the illness. Another explanation might be that patients feeling worse psychologically also use more pessimistic comparisons. It might be hard for them to view their situation from a more positive angle. Additionally, negative comparisons possibly elicit a negative downward spiral; patients already feeling unwell might feel even worse because of these pessimistic comparisons. Longitudinal research is needed to reveal causality and long-term effects.

The present findings extend previous research on the effects of virtual support community participation by showing that a direct positive relationship between the intensity of participation and well-being might not always hold. Patient-specific processes and characteristics, such as social comparison mechanisms, might affect well-being outcomes. Recent studies have started looking into the influence of individual differences on the effects of online support community participation, such as self-efficacy (Namkoong et al., 2010) and coping with emotions (Batenburg & Das, 2014). Gaining more insight into moderating factors is essential to increase our understanding of online peer-to-peer support effects on psychological well-being, as online support community effects may be multidimensional in nature due to different psychological processes. Findings also suggest that some types of online activity appear to impact well-being more than other activities. In the present research, frequency of posts and average length of online visits were especially related to well-being, and online engagement and frequency of visits were not. These findings suggest that some level of immersion in the online environment may be needed to produce (beneficial or detrimental) effects on well-being, and that merely being online, e.g., by quickly scanning stories from others, may not produce such immersion. Future research should further examine this possibility.

Current findings also showed that other factors outside the online environment affect patients' psychological well-being, such as perceived support from friends and family, and illness stage. Since self-generated, peer-led, online support communities are "uncontrolled" online environments – i.e., patients are anonymous, start participating and leave the online community at different points in time, and differ in online activity- it is almost impossible to create a matched control group. Therefore including other factors outside the online environment is essential to uncover the "bigger picture"; it enables to distinguish the effects of online processes from offline factors that also play an important role when it comes to patients' psychological well-being. In the present case, the interaction between the amount of posts and downward identification on breast cancer-related concerns remained significant when controlling for significant offline factors such as working status, psychological help from a professional and offline social support, but the interactions between length of visits and downward identification on depression and breast cancer-related concerns did not. Likewise, while the direct relationships observed between upward contrast comparisons and measures of well-being remained significant when controlling for offline factors, the direct relationship between downward identification and well-being did not. Researchers should be careful not to develop tunnel vision when conducting CMC studies,

and include offline factors into the equation to prevent the overestimation of the importance of online factors.

### **Limitations and Future Research**

A limitation of the present study is its cross-sectional nature that prevents us from drawing causal conclusions. As stated previously, the main purpose of this research was to provide a first step in assessing the relationship between online activity, social comparison strategies, and psychological well-being. Now that we established that social comparisons probably play a role when it comes to virtual support community participation and psychological well-being, future studies should further investigate issues of causality. In addition, future studies should investigate why we found differential results across different dependent measures. In the present research we observed interaction effects on depression and breast cancer related concerns but not on emotional well-being. Conversely, another recent study that used the same dependent measures found interactions between online activity and a user trait, in this case emotional approach coping, on emotional well-being and depression, but no effects on breast cancer-related concerns (Batenburg & Das, 2014). Apparently, different moderators affect different aspects of well-being. It could be that social comparisons tap into cognitive processes while coping styles may be more strongly related to emotion-type measures, but, again, future research is needed to test this assumption.

To measure online behavior, 4 single-item measures have been used to assess different kinds of online activity (i.e., amount of visits, posting behavior, approximate length of visits, and online engagement). Although online activity is a rather simple construct to measure, single-item measures may be less reliable than multiple-item measures. It is unclear why the measure of online engagement was not related to outcome measures. Because this measure assesses active versus passive online activity but not the frequency of these activities, it may not be the best of measures to assess subtle differences in online behavior.

Furthermore, the current sample of online support group users included a relatively large proportion of breast cancer survivors who were currently not under treatment. Even though cancer survivors never get the official status of being cured after treatment and the recovery period often takes quite some time, future research is needed to confirm if the same results hold with a sample of patients who are in the midst of treatment. Likewise, the current user sample was rather active online. Other studies generally show about 50% lurkers in health communities (Preece et al., 2004; Setoyama et al., 2011); in the present research, only 38.6% of users did not post in the last 4 weeks. A more varied sample of active and passive users could result in stronger (main) effects of online activity on psychological well-being.

### **Conclusion**

Virtual support communities provide patients with the unique opportunity to compare their own situation with that of peers, and draw pessimistic or optimistic conclusions from these comparisons. Our findings suggest that pessimistic comparisons have an influence on the psychological well-being of active users in particular: Active users who identified with online peers worse off than them (i.e., downward identification), or patients who experienced negative affect when reading stories from online peers doing better (i.e., upward contrast), reported lower psychological well-being than patients who did not compare themselves negatively with others. Although increased online activity enables users to find hope, recognition, and understanding by comparing their own situation with that of others, these users should be careful not to become “entrapped” by negative social comparison processes. The present research focused on online support communities, but the relevance of social comparison strategies may extend to other CMC platforms as well.

## References

- APA Council of Representatives. (2010). Amendments to the 2002 "Ethical principles of psychologists and code of conduct". *American Psychologist*, 65(5), 493. doi: 10.1037/a0020168
- Barak, A., Boniel-Nissim, M., & Suler, J. (2008). Fostering empowerment in online support groups. *Computers in Human Behavior*, 24(5), 1867–1883. doi:10.1016/j.chb.2008.02.004
- Batenburg, A., & Das, E. (2014). Emotional approach coping and the effects of online peer-led support group participation among patients with breast cancer: A longitudinal study. *Journal of Medical Internet Research*, 16(11), e256. doi:10.2196/jmir.3517
- Baumeister, R. F., Bratslavsky, E., Finkenauer, C., & Vohs, K. D. (2001). Bad is stronger than good. *Review of General Psychology*, 5(4), 323–370. doi:10.1037/1089-2680.5.4.323
- Brady, M. J., Cella, D. F., Mo, F., Bonomi, A. E., Tulskey, D. S., Lloyd, S. R., ... Shimoto, G. (1997). Reliability and validity of the functional assessment of cancer therapy-breast quality-of-life instrument. *Journal of Clinical Oncology*, 15(3), 974–86.
- Burke, M., Marlow, C., & Lento, T. (2010). Social network activity and social well-being. *Proceedings of the 28th International Conference on Human Factors in Computing Systems - CHI '10*, 1909. doi:10.1145/1753326.1753613
- Buunk, B. P., Collins, R. L., Taylor, S. E., VanYperen, N. W., & Dakof, G. A. (1990). The affective consequences of social comparison: Either direction has its ups and downs. *Journal of Personality and Social Psychology*, 59, 1238–1249. doi:10.1037/0022-3514.59.6.1238
- Cunningham, M. R., & Barbee, A. P. (2000). Social support. In C. A. Hendrick & S. S. Hendrick (Eds.), *Close relationships: A sourcebook* (pp. 272–285). California: SAGE Publications.
- Davison, K. P., Pennebaker, J. W., & Dickerson, S. S. (2000). Who talks? The social psychology of illness support groups. *The American Psychologist*, 55(2), 205–17.
- Dibb, B., & Yardley, L. (2006). How does social comparison within a self-help group influence adjustment to chronic illness? A longitudinal study. *Social Science & Medicine* (1982), 63(6), 1602–13. doi:10.1016/j.socscimed.2006.03.031
- Fox, J., & Moreland, J. J. (2015). The dark side of social networking sites: An exploration of the relational and psychological stressors associated with Facebook use and affordances. *Computers in Human Behavior*, 45, 168–176. doi:10.1016/j.chb.2014.11.083
- Haferkamp, N., & Krämer, N. C. (2011). Social comparison 2.0: Examining the effects of online profiles on social-networking sites. *Cyberpsychology, Behavior and Social Networking*, 14(5), 309–14. doi:10.1089/cyber.2010.0120
- Helgeson, V. S., Cohen, S., Schulz, R., & Yasko, J. (2001). Long-term effects of educational and peer discussion group interventions on adjustment to breast cancer. *Health Psychology*, 20(5), 387–392. doi:10.1037//0278-6133.20.5.387
- Irwin, M., Artin, K. H., & Oxman, M. N. (1999). Screening for depression in the older adult: Criterion validity of the 10-item Center for Epidemiological Studies Depression Scale (CES-D). *Archives of Internal Medicine*, 159(15), 1701–4.
- Kross, E., Verduyn, P., Demiralp, E., Park, J., Lee, D. S., Lin, N., ... Ybarra, O. (2013). Facebook use predicts declines in subjective well-being in young adults. *PloS One*, 8(8), e69841. doi:10.1371/journal.pone.0069841
- Legg, M., Occhipinti, S., Ferguson, M., Dunn, J., & Chambers, S. K. (2011). When peer support may be most beneficial: The relationship between upward comparison and perceived threat. *Psycho-Oncology*, 20, 1358–62. doi:10.1002/pon.1862
- Lieberman, M. A. (2007). The role of insightful disclosure in outcomes for women in peer-directed breast cancer groups: A replication study. *Psycho-Oncology*, 16(10), 961–4. doi:10.1002/pon.1181

- Lieberman, M. A., & Goldstein, B. A. (2005). Self-help on-line: An outcome evaluation of breast cancer bulletin boards. *Journal of Health Psychology*, 10(6), 855–62. doi:10.1177/1359105305057319
- Lieberman, M. A., & Goldstein, B. A. (2006). Not all negative emotions are equal: The role of emotional expression in online support groups for women with breast cancer. *Psycho-Oncology*, 15(2), 160–8. doi:10.1002/pon.932
- Morris, B. A., Campbell, M., Dwyer, M., Dunn, J., & Chambers, S. K. (2011). Survivor identity and post-traumatic growth after participating in challenge-based peer-support programmes. *British Journal of Health Psychology*, 16, 660–674. doi:10.1348/2044-8287.002004
- Nagler, R. H., Gray, S. W., Romantan, A., Kelly, B. J., DeMichele, A., Armstrong, K., ... Hornik, R. C. (2010). Differences in information seeking among breast, prostate, and colorectal cancer patients: Results from a population-based survey. *Patient Education and Counseling*, 81 Suppl, S54–62. doi:10.1016/j.pec.2010.09.010
- Namkoong, K., Shah, D. V., Han, J. Y., Kim, S. C., Yoo, W., Fan, D., ... Gustafson, D. H. (2010). Expression and reception of treatment information in breast cancer support groups: How health self-efficacy moderates effects on emotional well-being. *Patient Education and Counseling*, 81 Suppl, S41–7. doi:10.1016/j.pec.2010.09.009
- Oldenburg, H., Vrancken Peeters, M.J., & van Bohemen, J. (2009). *Het Borstkanker Boek* (4th ed., p. 109). Amsterdam: Thoeris.
- Preece, J., Nonnecke, B., & Andrews, D. (2004). The top five reasons for lurking: Improving community experiences for everyone. *Computers in Human Behavior*, 20(2), 201–223. doi:10.1016/j.chb.2003.10.015
- Protection of personal data. (2012). Retrieved October 9, 2013, from <http://ec.europa.eu/justice/data-protection/>
- Rodgers, S., & Chen, Q. (2005). Internet community group participation: Psychosocial benefits for women with breast cancer. *Journal of Computer-Mediated Communication*, 10(4), 00–00. doi:10.1111/j.1083-6101.2005.tb00268.x
- Sandaunet, A. (2008a). The challenge of fitting in: Non-participation and withdrawal from an online self-help group for breast cancer patients. *Sociology of Health & Illness*, 30(1), 131–44. doi:10.1111/j.1467-9566.2007.01041.x
- Sandaunet, A. (2008b). A space for suffering? Communicating breast cancer in an online self-help context. *Qualitative Health Research*, 18(12), 1631–41. doi:10.1177/1049732308327076
- Setoyama, Y., Yamazaki, Y., & Namayama, K. (2011). Benefits of peer support in online Japanese breast cancer communities: differences between lurkers and posters. *Journal of Medical Internet Research*, 13(4), e122. doi:10.2196/jmir.1696
- Spencer, S. M., Lehman, J. M., Wynings, C., Arena, P., Carver, C. S., Antoni, M. H., ... Love, N. (1999). Concerns about breast cancer and relations to psychosocial well-being in a multiethnic sample of early-stage patients. *Health Psychology*, 18(2), 159–68.
- Tandoc, E. C., Ferrucci, P., & Duffy, M. (2015). Facebook use, envy, and depression among college students: Is facebooking depressing? *Computers in Human Behavior*, 43, 139–146. doi:10.1016/j.chb.2014.10.053
- Tanis, M., Das, E., & Fortgens, M. (2011). Who gives care to the caregiver? Participation in online health forums positively affects caregivers' wellbeing. *Communications: European Journal of Communication Research*, 36, 51–66. doi:10.1515/COMM.2011.003
- Van der Zee, K., Buunk, B., Sanderman, R., Botke, G., & van den Bergh, F. (2000). Social comparison and coping with cancer treatment. *Personality and Individual Differences*, 28(1), 17–34. doi:10.1016/S0191-8869(99)00045-8



- Van Uden-Kraan, C. F., Drossaert, C. H. C., Taal, E., Shaw, B. R., Seydel, E. R., & van de Laar, M. A. F. J. (2008a). Empowering processes and outcomes of participation in online support groups for patients with breast cancer, arthritis, or fibromyalgia. *Qualitative Health Research*, 18(3), 405–17. doi:10.1177/1049732307313429
- Van Uden-Kraan, C. F., Drossaert, C. H. C., Taal, E., Seydel, E. R., & van de Laar, M. A. F. J. (2008b). Self-reported differences in empowerment between lurkers and posters in online patient support groups. *Journal of Medical Internet Research*, 10(2), e18. doi:10.2196/jmir.992
- Van Uden-Kraan, C. F., Drossaert, C. H. C., Taal, E., Seydel, E. R., & van de Laar, M. A. F. J. (2009). Participation in online patient support groups endorses patients' empowerment. *Patient Education and Counseling*, 74(1), 61–9. doi:10.1016/j.pec.2008.07.044
- Vilhauer, R. P. (2009). Perceived benefits of online support groups for women with metastatic breast cancer. *Women & Health*, 49(5), 381–404. doi:10.1080/03630240903238719
- Walther, J. B., & Boyd, S. (2002). Attraction to computer-mediated social support. In C. A. Lin & D. Atkin (Eds.), *Communication technology and society: Audience adoption and uses* (pp. 153–188). Cresskill, NJ: Hampton Press.
- Wen, K.Y., McTavish, F., Kreps, G., Wise, M., & Gustafson, D. (2011). From diagnosis to death: A case study of coping with breast cancer as seen through online discussion group messages. *Journal of Computer-Mediated Communication*, 16(2), 331–361. doi:10.1111/j.1083-6101.2011.01542.x
- Wet bescherming persoonsgegevens. (2013). Retrieved October 9, 2013, from [http://wetten.overheid.nl/BWBR0011468/geldigheidsdatum\\_11-07-2013](http://wetten.overheid.nl/BWBR0011468/geldigheidsdatum_11-07-2013)

## About the Authors

**Anika Batenburg** obtained her PhD at the department of Communication Science at the VU University Amsterdam, and is currently Assistant Professor at the department of Communication and Information Studies and Centre of Language Studies at Radboud University Nijmegen, the Netherlands. Her research focuses on online communities and social media in the health and organizational domain (e-mail address: [a.batenburg@let.ru.nl](mailto:a.batenburg@let.ru.nl)).

**Enny Das** is a Professor of Communication and Persuasion at the department of Communication and Information Studies and Centre for Language Studies at Radboud University Nijmegen, the Netherlands. Her research focuses on health communication and marketing communication (e-mail: [h.das@let.ru.nl](mailto:h.das@let.ru.nl)).