Do virtual communities matter for the social support of patients?
Antecedents and effects of virtual relationships in online communities

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Abstract

Purpose – The purpose of this paper is to explore whether online communities meet their potential of providing environments in which social relationships can be readily established to help patients cope with their disease through social support. The paper aims to develop and test a model to examine antecedents of the formation of virtual relationships of cancer patients within virtual communities (VCs) as well as their effects in the form of social assistance.

Design/methodology/research – Data were collected from members of virtual patient communities in the German-speaking internet through an online survey to which 301 cancer patients responded. The data were analyzed with partial least square (PLS) structural equation modeling.

Findings – Virtual relationships for patients are established in VCs and play an important role in meeting patients' social needs. Important determinants for the formation of virtual relationships within virtual communities for patients are general internet usage intensity (active posting vs lurking) and the perceived disadvantages of CMC. The paper also found that virtual relationships have a strong effect on virtual support of patients; more than 61 per cent of the variance of perceived social assistance of cancer patients was explained by cancer-related VCs. Emotional support and information exchange delivered through these virtual relationships may help patients to better cope with their illness.

Research limitations/implications – In contrast to prior research, known determinants for the formation of virtual relationships (i.e. marital status, educational status, gender, and disease-related factors such as the type of cancer as control variables, as well as general internet usage motives, and perceived advantages of CMC as direct determinants) played a weak role in this study of German cancer patients. Studies on other patient populations (i.e. patients with other acute illnesses in other cultures) are needed to see if results remain consistent.

Practical implications – Participants and administrators of patient VCs have different design criteria for the improvement of VCs for patients (e.g. concerning community management, personal behaviour and the usage of information in online communities). Once the social mechanisms taking place in online communities are better understood, the systematic redesign of online communities according to the needs of their users should be given priority.

Originality/value – Little research has been conducted examining the role of VCs for social relationships and social networks in general and for patients in particular. Antecedents and effects of virtual social relationships of patients have not been sufficiently theoretically or empirically researched to be better understood. This research combines various determinants and effects of virtual relationships from prior related research. These are integrated into a conceptual model and applied empirically to a new target group, i.e. VCs for patients.

Keywords Patients, Social networks, Germany, Cancer, Internet

Paper type Research paper

Motivation

"*Amicus Certus in Re Incerta Cernitur*".

A true friend is discerned during an uncertain matter (Marcus Tullius Cicero (106-43AC), quoted in Ennius, *De amicitia* 17, 64).

This research was motivated by the suboptimal situation of the provision of support to cancer patients in Germany. A social stigma is still attached to cancer so that societal distancing from cancer patients occurs. Although the German healthcare system provides adequate medical care, it is less supportive in terms of addressing the informational and emotional needs of individuals suddenly faced with treatment decisions and dramatic life changes. The social support that patients receive through their social network plays a central role in meeting emotional needs (Eysenbach *et al.*, 2004). This support positively affects the process of adjusting to the new situation, the well being of the patients, and their attitudes in coping with a life-threatening disease (Reeves, 2000). Existing social relationships do not always provide needed support – be it because of the stigma of the disease or a potential psychological crisis of the social exchange partner induced by the destiny of a beloved one (Holland and Holahan, 2003). Not only the patient, but also the patient's family needs support and reliable social networks to help in coping with the disease (Sloper, 2000; Leydon *et al.*, 2000; Eriksson, 2001). Furthermore emotional and informational needs vary between patients, relatives and friends (Taylor, 2003). In many cases existing social relationships break down under the burden of the disease (Classen *et al.*, 1996; Hughes, 1982) and new relationships are needed as a source of support. For many patients, the internet has become not only a resource for health information, but also a source of support and community-building (Josefsson, 2002; Manaszewicz *et al.*, 2002). Ethnographic analyses of online patient communities (Maloney-Krichmar and Preece, 2005; Josefsson, 2003, 2005) have shown that cancer-related virtual communities (VCs) can be a place to establish supportive relationships. Virtual community social support exists (Abras 2003; Wright, 2000a; Leimeister and Krcmar, 2005a; Carter, 2005) and strong social relationships can be built in these communities (Carter, 2005). There are, however, risks involved in the establishment of internet communities: the existence of para-social relationships (Ballantine and Martin, 2005) has been identified in VCs and unfortunately, because anonymity is so easily preserved in the internet, danger from people pretending to be cancer patients also exists. Thus, there is an element of distrust associated with internet relationship building (Haythornthwaite, 2002, 2007).

Previous studies in IS research have addressed the role of trust in VCs in general (Ridings *et al.*, 2002) and patient communities in particular (Leimeister *et al.*, 2005) and ways in which VC designers can support perceived competence and goodwill among VC members have been discussed (Leimeister *et al.*, 2005). VCs have a potential to offer significant advantages to patients. For example, patient participation in VCs is believed to have an impact not only on the social welfare of the patient, but also on health outcomes (Eysenbach *et al.*, 2004).

Online healthcare communities are receiving increased research attention as new special interest groups (Neal *et al.*, 2006, 2007). However, much is still unknown about the design and impact of these groups and no theories or models exist to address two specific questions of interest, which are:

(1) What are the determinants on the development of virtual relationships?

(2) What is the effect of these virtual relationships on the social support patients perceive?

This research specifically looks at the role that cancer-related virtual communities play in supporting the development of virtual relationships of cancer patients within their social network. Additionally, the role of these VC-based virtual relationships on the perceived virtual social support is examined. Our approach follows the recent call for contextual network research, which focuses on temporal and causal aspects such as identifying the antecedents and evolution of networks (Parkhe *et al.*, 2006).

We therefore develop and empirically test a conceptual model that integrates and extends existing related concepts and theories for new areas of application, in this case for VCs for cancer patients.

General and theoretical background

Web-based services for cancer patients

According to a 2007 study from the German state television based on a representative data set of the German population, German-language web sites related to healthcare are still a growing service segment (Van Eimeren and Frees, 2007). In 2003, 24 per cent of the adult population in Germany used the internet to find health-related information (Spadaro, 2003) and these numbers have risen significantly in recent years. In 2006, in the USA almost 8 million people searched the web for health information every day, and these numbers have been maintained for the last three years according to the Pew Internet and Life Project (Fox, 2006). In addition to strictly informational web sites, numerous offerings exist that allow user-to-user interaction by such means as mailing lists, newsgroups or chat rooms (Dannecker and Lechner, 2006, 2007).

Online personal health information management is also getting more attention in research (Pratt *et al.*, 2006). A study conducted by Daum (2005) showed that interaction services have become increasingly popular on cancer-related web sites. In 2001 most German cancer-related web sites were purely information-oriented, whereas in 2002 a shift had occurred to more web sites supporting interaction services. The researchers found that 18 per cent of web sites offered a bulletin board or an online forum, and chat capabilities were included in 5 per cent of the web sites (Daum, 2005) with a doubling of these rates each year through 2005. Overall Germany is experiencing a growth in health-related internet interaction services with this general trend being reflected in an increase in cancer-related online interaction services. Internet trends such as Web 2.0 technologies leverage this growth significantly. This clearly reflects a need for interaction services, but the question to be asked is whether these offerings meet their theoretical potential to support users and families in coping with cancer.

Because cancer is a life threatening disease, patients' needs for emotional and informational support are more intense than for patients with other non-life-threatening diseases (Satterlund *et al.*, 2003; Meric *et al.*, 2002) and thus far, research on VCs for patients has paid little attention to this difference. We therefore focus on antecedents and effects of virtual relationships of cancer patients in VCs.

Online communities and virtual relationships

Before looking at previous studies that have investigated the potential of online communities to establish social relationships, it is important to define the two key

concepts used in this research: online communities and virtual relationships. As there is no common agreement on one specific definition of online communities, for the purpose of this study they are defined using some of the key aspects that are repeatedly mentioned (Preece, 2000; Blanchard and Markus, 2004; Rheingold, 2000; Haythornthwaite, 2007). Online communities are groups of people who:

- meet and interact with others;
- are connected by a specific interest;
- are brought together by means of a technical platform; and
- and can establish social relationships or a sense of belonging to this group.

Social relationships are characterized by a repeated interaction between two persons whereas the individual interaction is influenced by previous interactions as well as the expectation of future interactions (Döring, 2003). The site of the first intereaction is used to differentiate between virtual and real-world relationships (Parks and Roberts, 1998). Hence, a virtual relationship is a relationship where the first contact took place online; a real-world relationship is a relationship where the first contact took place offline.

During the early days of computer-mediated communication and web-based interaction services, numerous scholars questioned whether the characteristics of computer-mediated communication were sufficiently rich to support the formation of social relationships (Parks and Floyd, 1996). However, the reports of numerous users of online interaction services and the results of several research studies have suggested that this is not a problem (Rosson, 1999; Rheingold, 2000). For example, Park and Floyd come to the conclusion that the emergence of social relationships via online services is common and widespread. Almost all of the prior research is in agreement that virtual relationships can be established (Haythornthwaite, 2007; Butler *et al.*, 2003) within online communities.

In the context of VCs for patients, remarkable evidence exists that virtual relationships initiated in these VCs can be very strong (Maloney-Krichmar and Preece, 2005; Leimeister and Krcmar, 2005b; Josefsson, 2005). Studies of VCs in general have shown that virtual relationships are looser than conventionally (off-line) initiated social relationships (Cummings *et al.*, 2002; Haythornthwaite, 2002, 2007). And, relationships, which are initiated by virtual interaction do not remain exclusively within a virtual environment but migrate to the real world (Cummings *et al.*, 2002; Parks and Roberts, 1998; Parks and Floyd, 1996).

Research model, hypotheses, and construct development
Selected influencing factors on the development of virtual relationships
Online communities provide a platform for users to establish social relationships. However, not all users of such services take advantage of this possibility. Thus, what are the factors that influence whether a person establishes social relationships via online interaction services?

According to Parks and Floyd (1996) the length of time an online offering is used and the frequency of usage are the best indicators of whether users of online services develop virtual relationships, a finding also confirmed by Wright (1999, 2000a, b). Furthermore, Nonnecke *et al.*, observed that active members of online communities who post on online bulletin boards develop stronger ties to the community than

members who just read postings (Lurkers) (Nonnecke *et al.*, 2004, Preece *et al.*, 2004). In accordance with these studies, we define intensity of internet usage as being determined by duration and frequency of use as well as the type of activity conducted (posting meaning a high level of interactivity and thus intensity vs lurking meaning a low level of intensity); the basis for the first hypothesis of this study:

H1. The intensity of internet usage positively influences the development of virtual relationships.

According to the uses-and-gratification approach in media usage research, individuals choose to use a certain type of media because they expect some kind of gratification from that usage (Burkart, 1998), similarly stated in "uses and gratification" theory (Katz and Foulkes, 1962). It can be concluded from this work that expected gratification influences internet usage behaviour. In accordance with this and other studies on the role of internet usage motives and their potential effects on cancer patients (Wright, 2002, Wright and Bell, 2003) this study focuses on whether different motives for internet usage influence the development of virtual relationships among cancer patients. Based on a study conducted by Wright, motives behind internet usage as defined by Papacharissi and Rubin (2000), are used for this study: Interpersonal utility (defined by statements such as "to help others" and "to belong to a group"), passing time (defined by statements such as "when I have nothing better to do" and "to occupy my time") and information seeking (defined by statements such as "to look for information" and "new way to do research"). This leads us to the second hypothesis:

H2. The motives behind internet usage positively influence the development of virtual relationships of cancer patients.

Wright (2002) highlights the role of perceived advantages and disadvantages of computer-mediated communication (CMC) affecting users' perceptions of their online experience. These advantages and disadvantages do not only influence whether virtual relationships are perceived as fulfilling, but also whether a person even establishes online relationships. Advantages and disadvantages of CMC have been identified by Wright (2000a, b) through a survey of participants in online self-help groups. We use these constructs and complement them by information gained through other studies. The advantages of CMC addressed in this study are: access to a wide-range of different persons and to persons with similar experiences; opportunities to interact with persons with whom only loose social ties exist (Turner *et al.*, 2001); independence from space and time constraints for meeting people; chances to communicate anonymously (Wright, 2000, 2002); and non-existing time-pressure to answer questions (Maloney-Krichmar and Preece, 2005; Turner *et al.*, 2001; Maloney-Krichmar and Preece, 2003). Disadvantages addressed in this study are: absence of human expressions (e.g. gestures); absence of the possibility for direct contact (e.g. hugging); behaviour of other users that is perceived negatively (e.g. hostile messages); and delayed feedback (Wright, 2002). These issues lead to the third and fourth hypotheses addressed in this study:

H3. The perceived advantages of CMC positively influence the development of virtual relationships of cancer patients.

H4. The perceived disadvantages of CMC negatively influence the development of virtual relationships of cancer patients.

Social support received through virtual relationships
We have argued that internet cancer support groups can build supportive social relationships. In the last step of this study we examine whether virtual relationships provide needed support. Wright (1999) noted that people join online self-help groups for the same reasons that people join real-world self-help groups. According to Turner *et al.* (2001), the support received through online interaction services is perceived to be as helpful as support provided by real-world contacts. Holland and Holahan (2003) even show that social support has a positive effect on coping and on positive adaption to breast cancer. Positive effects of online support are also noted by Gustafson *et al.* (2001) and Maloney-Krichmar and Preece (2005). Both studies reported that members of online self-help groups handle information about their disease better because of the online support they received and their emotional situation improved (Gustafson *et al.*, 2001; Maloney-Krichmar and Preece, 2005). A study conducted by Loader *et al.* (2002) identified both emotional and informational support being provided by virtual relationships. Using the same measurement scales, Muncer *et al.* (2000) identified all types of support provided by virtual relationships except instrumental support. Both studies used the constructs and scales for "social companionship support", "informational support", "self-esteem support" and "instrumental support" as developed by Cohen/Wills (1985). These studies suggested that virtual relationships do provide support beyond serving information needs, but not enough is known about the types of support being provided or about support needs that are not met virtually. This leads to the fifth hypothesis:

H5. Virtual relationships positively affect virtual social support of cancer patients.

Parks and Floyd (1996) come to the conclusion that socio-demographic characteristics have a relatively weak influence on the socialising behaviour of users of online services. However, this result might be due to the interaction service used in the study. For example, Wellman and Gulia (2001) note: "The net is only one of many ways in which the same people may interact. It is not a separate reality. People bring to their online interactions baggage such as gender, stage in lifecycle, cultural milieu, socio-economic status, and offline connection with others". Gefen and Ridings (2005) found that gender differences significantly affect motives and interaction patterns in VCs. We therefore regard socio-demographic factors such as age and gender as control variables to assess whether our research model accurately predicts changes in the development of virtual relationships among cancer patients.

Disease-related factors, such as the type of cancer or the stage of disease, might also influence the establishment of virtual relationships. It is possible that persons suffering from rare types of cancer are more likely to turn to the internet to search for information about their disease than people with common types of cancer (Klemm *et al.*, 2003; Leydon *et al.*, 2000). Previous research has shown that the stage of the disease (Fogel *et al.*, 2002; Satterlund *et al.*, 2003) and the development of social relationships in general (Classen *et al.*, 1996; Samarel *et al.*, 2002) influence internet use. Therefore, we consider stage of disease (measured by the time span since the first diagnosis) and the type of disease as control variables and test if these distinctive characteristics have an influence on the overall model. Table I summarizes the research hypotheses.

Consolidating all five hypotheses the following research model emerges (Figure 1).

Construct development
Table II depicts the operationalisation of the constructs "Internet usage intensity", "Motives of internet usage", "Perceived advantages of CMC", "Perceived disadvantages of CMC", "Virtual relationships" and "Virtual social support" used in the VRSS research model.

Method
Using an explorative research approach to allow the necessary openness for unexpected results (Bortz and Döring, 2005; Myers, 1997), we conducted eight semi-standardized interviews with operators of VCs for cancer patients, cancer self-help group leaders and professional counselors for cancer patients from the German Cancer Research Center (KID) before study initiation. These results were used to elaborate, operationalise, and transfer the theoretical framework (Figure 1) into a structural equation model. Each construct is represented by a set of indicators, i.e. questions in a questionnaire, which were measured on a five-point Likert scale. The

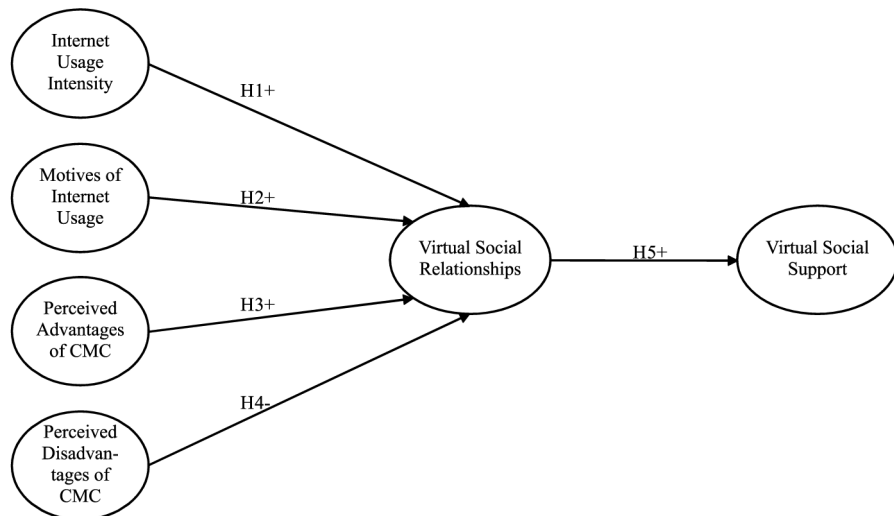| No.	Description of hypothesis
H1	Intensity of internet usage positively influences the development of virtual relationships
H2	The motives behind internet usage positively influence the development of virtual relationships of cancer patients
H3	The perceived advantages of CMC positively influence the development of virtual relationships of cancer patients
H4	The perceived disadvantages of CMC negatively influence the development of virtual relationships of cancer patients
H5	Virtual relationships positively affect virtual social support of cancer patients

Table I.
Research hypotheses

Figure 1.
Virtual-Relationship-
Social-Support (VRSS)
research model

Construct	Item	Question/indicator/factor	Level of measurement/ type of variable
Internet usage intensity *Formative*	I_Gen_Usage	How many hours per week (per average) are you online?	Metric/continuous
	I_Canc_Usage	How many hours per week (per average) are you online using cancer-related offerings?	Metric/continuous
	I_SelfHelpGroup_Usage	How many hours per week (per average) do you use offerings where you can interact with other cancer-affected?	Metric/continuous
	Type_I_Usage	Factor extracted from ten items on different internet usage differentiating between active (= interaction) and passive (information consumption) usage	Metric/continuous
Motives of internet usage *Formative*	Interaction_M	Interpersonal utility. Factor extracted from 12 items on motives of internet usage from Papacharissi and Rubin (2000)	Metric/continuous
	Information_M	Information seeking; factor extracted from 12 items on motives of internet usage from Papacharissi and Rubin (2000)	Metric/continuous
	Amusement_M	Pass time. Factor extracted from 12 items on motives of internet usage from Papacharissi and Rubin (2000)	Metric/continuous
Perceived advantages of CMC *Formative*	Ad_Anonymity	I can remain anonymous	Metric/continuous
	Ad_Prejudice	There is no prejudice through others	Metric/continuous
	Ad_Openness	On the Internet it is easier for me to be open	Metric/continuous
	Ad_Independent_Place	I can use internet offerings independently from a specific place	Metric/continuous
	Ad_Independent_Time	I can use the internet independently from time of day	Metric/continuous
	Ad_Diversity	The internet allows me to contact many different persons with a lot of different experiences and information with regard to cancer	Metric/continuous
	Ad_Similarity	The internet allows me to find other people who made similar experiences	Metric/continuous
	Ad_Information_Quality	Answers are more profound than in most face-to-face conversations since people have more time to formulate their answers	Metric/continuous
Perceived disadvantages of CMC *Formative*	Dis_Haptic	On the internet there are no possibilities to touch your conversation partner (e.g. hugging, etc.)	Metric/continuous
	Dis_Gestures	Lack of gestures and facial expression can lead to misunderstandings	Metric/continuous
	Dis_Voice	There is no possibility to hear your conversation partner's voice	Metric / continuous
	Dis_Hostility	Other people make hostile remarks	Metric / continuous

(continued)

Table II.
Operationalisation of
constructs

Construct	Item	Question/indicator/factor	Level of measurement/typeof variable
	Dis_Distraction	Other people are making remarks that don't have anything to do with the subject	Metric/continuous
	Dis_False_Info	Sometimes people make comments on the internet that are factually wrong	Metric/continuous
	Dis_Misleading_Info	Sometimes people make comments on the internet that are misleading	Metric/continuous
	Dis_Reply_Time	It takes longer to get answers than in a face-to-face conversations	Metric/continuous
	Dis_Accessability	My conversation partners are not always accessible since they are not online all the time	Metric/continuous
Virtual social relationships *Reflective*	Dis_Personal_Relationship	The internet makes it difficult to establish personal relationships	Metric/continuous
	Number_Soc_Rel	Number of virtual social relationships that meet the definition of a social relationship using Parks and Roberts (1998) instrument. "Please describe your most important contact person with respect to cancer that you have met over the internet using the following items…"	Metric/continuous
Virtual social support *Reflective*	SocSup_1	When I need a contact person related to cancer there is always someone there for me	Metric/continuous
	SocSup_2	When I need advice there is always someone there is always someone available for me	Metric/continuous
	SocSup_3	It happens frequently that if I need someone to distract me from my sorrow and then there is no one there for me	Metric/continuous
	SocSup_4	If I want to meet someone tonight because I am not feeling well I will definitely find someone to meet with	Metric/continuous
	SocSup_5	If I felt physically bad there would be someone there to help me out	Metric/continuous
	SocSup_6	Even if I don't want to hear it there is always someone there to give me honest feedback	Metric/continuous
	SocSup_7	When I have a problem there will always be someone there to help me	Metric/continuous
	Support_Gen	I feel supported by my internet friends	Metric/continuous

Table II.

questions in these different blocks were either adopted and adapted from previous research or from a second qualitative pre-study consisting of expert interview conducted with ten operators and ten active VC participants.

An online survey was used because a relatively large number of cancer patients using cancer-related online communities in the German-speaking internet formed the population for this research. Using the online cancer-support web sites gave us the opportunity to obtain a representative sample of users, although there is no way of knowing the characteristics of the non-respondents. Important design parameters of the online survey are summarized in Table III.

The online survey contained six blocks of questions relevant to this study: general internet usage behaviour and intensity, usage behaviour of cancer-related web sites, virtual relationships developed through these web sites, the perceived social support obtained from these relationships, the perceived advantages and disadvantages of CMC, the motives for engaging in cancer-related internet sites, and the socio-demographic and cancer-related characteristics of the respondents.

The questionnaire was published on our university web site. We then uncovered a total of 60 cancer-related web sites written in German (for the list of web sites and more details on the process see (Daum, 2005)). We solicited the institutions supporting these web sites for permission to post a link to our questionnaire on their web site. Of the 60 web sites, managers of 28 agreed to publish a link to our online survey. Participation in the study was entirely voluntary and no remunerations were given to the respondents. In total, 377 people took part in the survey resulting in 315 completed questionnaires. Of these 315 respondents, 301 data sets were found to be completed in full and therefore usable for this study; we removed data sets filled in by relatives of cancer patients. In these 301 data sets all six blocks of questions were answered completely as the questionnaire was only saved if it was completed.

The research model was operationalised and transferred into a structural equation model (SEM) to be analyzed with the PLS approach (Chin, 1998; Wold, 1985). PLS is particularly suitable if a more explorative analysis close to the empirical data is preferred. To our knowledge, there is no strong theoretical foundation or even empirical evidence on the interplay of determinants and effects of virtual relationships for cancer patients. For these reasons, we believe that an explorative approach seems to be most appropriate.

All calculations for the data analysis were carried out with PLS-Graph Version 3.0. Settings were left to default, except the number of bootstrap samples, which was increased to 500.

Research method	Online-survey
Population	No exact number measurable; in theory, all cancer patients that use German web sites dedicated to cancer-related topics
Sample type	*Ad hoc* sample
Approach to contact potential participants	Text with information and link to the survey; posted in 28 German web sites aligned to cancer-related topics
Number of respondents/number of usable data sets	315/301

Table III.
Summary of study design parameters

Empirical results

Characteristics of the survey participants

Of the 301 cancer patients participating in this survey, 204 were female and 97 were male. The age of the respondents varied widely; the majority of participants were aged 30-59 ($n = 229$). Breast cancer ($n = 87$) was the most common type of cancer, followed by haematologic neoplasms ($n = 50$). The frequency of using the internet and the frequency of specifically using internet services related to cancer was relatively high. For example, 233 respondents used the internet on a daily basis and on average the respondents spent 14 hours per week online.

Control variables

In order to control for the influence of participant characteristics, certain factors were analyzed to assess their influence on the study results. These factors were: marital status, educational status, gender, and disease-related factors such as the type of cancer. Multi-group analysis (Chin, 2000) was conducted for the categorical variables and no statistically significant influence of the tested variables on the structural model was detected. These findings are in accordance with Parks and Floyd who come to the conclusion that socio-demographic characteristics have a relatively weak influence on the socialising behaviour of users of such online services (Parks and Floyd, 1996).

Time since the first diagnosis and age of the respondent were also considered as control variables and the effect was measured through a one-indicator-construct loading on the development of Virtual Relationships (Dibbern and Chin, 2005). The result showed weak loading (path coefficient 0.117, respectively -0.081) and was not significant at the 0.01 level (*t*-value 2.2 respectively 1.45), implying that in our sample the variables "time since diagnosis" and "age of the respondent" did not significantly impact on the development of virtual relationships. Thus, the assumption that persons with uncommon types of cancer are more likely to establish virtual relationships than persons with common types of cancer could not be shown.

Model validation

Formative measurement model. In our model, the determinants of the formation of virtual social relationships (i.e. characteristics of the user, internet usage intensity, motives of internet usage, perceived advantages and disadvantages of CMC) were operationalised in formative mode. In order to determine the relationship between the measures and the constructs applied in our research model (whether the constructs should be operationalised with a reflective or formative indicator measurement model) we applied the four sets of questions (Jarvis *et al.*, 2003). We not only examined the relationship between the items and their constructs by using conceptual and statistical criteria (Jarvis *et al.*, 2003), but also followed semantic logic with regard to the content (Rossiter, 2002). In addition and in line with Rossiter (2002), we involved opinions, expertise, and knowledge of experts in pre-tests to develop items and constructs and used existing scales and constructs developed in extant research. We found that some of our constructs, internet usage intensity, perceived advantages and disadvantages of CMC, could have been operationalised with both formative and reflective indicators, However, according to Huber *et al.* (2007), the constructs should be operationalised in a formative mode if manifest, measureable, and designable aspects of the construct are of interest. In our model, we were interested in the items that shape and constitute the

determinants of the formation of virtual social relationships. Therefore these
constructs were operationalised in formative mode as they also meet the criteria put
forward in (Jarvis *et al.*, 2003) for formative measurement models.

To evaluate the quality of the formative measurement model, the design of
constructs (Diamantopoulos and Winklhofer, 2001) as well as the relevance of
indicators (Chin, 1998) has to be analyzed.

According to the findings of (Diamantopoulos and Winklhofer, 2001) and (Chin,
1998) five critical issues to determine the quality of the measurement model have to be
investigated:

(1) Content specification.

(2) Indicator specification.

(3) Indicator reliability.

(4) Indicator collinearity.

(5) External validity.

Content specification consists of defining the scope of the latent constructs to be
measured. This is of particular importance, as within formative models the indicators
form the latent variable. "The breadth of definition is extremely important to causal
indicators" (Nunnally and Bernstein, 1994), because "failure to consider all facets of
the construct will lead to an exclusion of relevant indicators" (Diamantopoulos and
Winklhofer, 2001). The research model we used included six latent constructs to be
measured with formative indicators: socio-demographic factors of the user,
disease-related factors of the user, internet usage intensity, motives of internet
usage, perceived advantages and perceived disadvantages of CMC. These constructs
were precisely defined and their domain intensively discussed, ensuring the proper
specification of the applicable content of all the constructs deployed.

Indicator specification comprises the identification and definition of indicators,
which constitute the latent constructs. As the aggregation of all formative indicators
defines the scope of the formatively measured latent variable, indicator specification is
particularly important for models using formative indicators (Diamantopoulos and
Winklhofer, 2001). The indicators used in this model were identified by intensive
literature review and have been validated through a series of in-depth expert
interviews with operators of virtual communities for cancer patients and cancer
self-help-group leaders who were knowledgeable about the topic of this research.
Following their input, some initial indicators have been altered to become more precise
and understandable to the target audience.

Indicator reliability analyzes the importance of each individual indicator that forms
the relevant construct. Two quantitative arguments have to be accounted for:

(1) The sign of the indicator needs to be correct as hypothesized.

(2) The weighting of the indicator should be at least 0.1 (Seltin and Keeves, 1994) or
at least 0.2 (Chin, 1998).

The analysis revealed that some indicators, especially in the constructs "perceived
advantages" and "perceived disadvantages" did not fulfil these requirements.
Although eliminating indicators, which do not fulfil the set criteria is recommended
(Seltin and Keeves, 1994), all indicators were kept in the model to show which of the

indicators has a significant effect and which do not. Because formative measurement models are based on multiple regression and linear equation systems, substantial indicator collinearity would affect the stability of indicator coefficients (Diamantopoulos and Winklhofer, 2001). In this study, multicollinearity among the indicators used did not pose a problem. The maximum variance inflation factor (VIF) was far below the common cut-off threshold of ten (Cohen, 2003) and even below the more conservative VIF threshold of 3.3 (Diamantopoulos and Siguaw, 2006). No further indicators needed to be rejected as no redundancy was identified.

External validity ensures the suitability of the deployed indicators and is of special importance for formative measurement models if indicators need to be eliminated. External validity shows the extent to which formative indicators actually capture the construct (Chin, 1998). Following Diamantopoulos and Winklhofer (2001), external validity can be tested by using nomological aspects linking the formative construct with another construct to be expected as antecedent or consequence, i.e. by creating a phantom construct which is measured using reflective indicators. If the formatively measured construct strongly and significantly correlates with the reflective measured construct, external validity is proven. The correlations of constructs within the tested model were all strong and significant at the 0.001 level. Thus, it was shown that the formative indicators used in this study actually form their respective constructs.

Reflective measurement model. Tests were conducted to show validity of the model constructs for the overall sample. It is necessary to ensure that the measures perform adequately. The quality of the reflective measurement model is determined by:

- convergent validity;
- construct reliability; and
- discriminant validity (Bagozzi, 1979; Churchill, 1979; Peter, 1981).

Convergent validity is analyzed by indicator reliability and construct reliability (Peter, 1981). Indicator reliability can be examined by looking at the construct loadings. In the model tested, all loadings are highly significant at the 0.0001 level and above the recommended 0.7 parameter value (Carmines and Zeller, 1979). Construct reliability was tested using:

- the composite reliability (CR); and
- the average variance extracted (AVE) (Fornell and Larcker, 1981).

Estimated indices were above the recommended thresholds of 0.6 (Bagozzi and Yi, 1988) respectively 0.7 (Nunnally, 1978) for CR and 0.5 for AVE (Fornell and Larcker, 1981). Discriminant validity of the construct items was assured by looking at the cross loadings which were obtained by correlating the component scores of each latent variable with both their respective block of indicators and all other items that are included in the model (Chin, 1998). As depicted in Table IV, all items load higher on their respective construct than on any other construct. Furthermore, the square root of the AVE for each construct was higher than correlations between constructs and implies discriminant validity for both samples. Table V depicts load/weight of items, construct reliability measures and AVE where applicable.

Item	Construct Virtual social relationships	Virtual social support
Number_Soc_Rel	*1.000*	0.787
Support_Gen	0.778	*0.983*
SocSup_1	0.785	*0.978*
SocSup_2	0.788	*0.983*
SocSup_3	0.770	*0.942*
SocSup_4	0.697	*0.917*
SocSup_5	0.661	*0.919*
SocSup_6	0.779	*0.974*
SocSup_7	0.768	*0.979*

Construct	Item	Load/weight	Significance level	CR	AVE
Internet usage intensity *Formative*	I_Gen_Usage	0.1235	n.s.		
	I_Canc_Usage	0.2252	n.s.		
	I_SHG_Usage	0.2739	n.s.		
	Type_I_Usage	0.7945	0.0001		
Motives of internet usage *Formative*	Interaction_M	0.9260	0.0001		
	Information_M	0.2661	0.1		
	Amusement_M	−0.0214	n.s.		
Perceived advantages of CMC *Formative*	Ad_Anonymity	−0.5820	0.01		
	Ad_Prejudice	−0.0180	n.s.		
	Ad_Openness	0.0924	n.s.		
	Ad_Independent_Place	0.4379	0.05		
	Ad_Independent_Time	0.0713	n.s.		
	Ad_Diversity	0.0961	n.s.		
	Ad_Similarity	0.6168	0.01		
	Ad_Information_Quality	−0.1176	n.s.		
Perceived disadvantages of CMC *Formative*	Dis_Haptic	−0.1208	n.s.		
	Dis_Gestures	0.1543	n.s.		
	Dis_Voice	0.0104	n.s.		
	Dis_Hostility	−0.3385	0.1		
	Dis_Distraction	0.3946	0.05		
	Dis_False_Info	0.0282	n.s.		
	Dis_Misleading_Info	−0.1594	n.s.		
	Dis_Reply_Time	−0.1464	n.s.		
	Dis_Accessability	−0.2797	0.05		
	Dis_Personal_Relationship	1.0386	0.0001		
Virtual social relationships *Reflective*	Number_Soc_Rel	1.00		1.00	1.00
Virtual social support *Reflective*	SocSup_1	0.9779	0.0001	0.989	0.921
	SocSup_2	0.9825	0.0001		
	SocSup_3	0.9418	0.0001		
	SocSup_4	0.9166	0.0001		
	SocSup_5	0.9191	0.0001		
	SocSup_6	0.9736	0.0001		
	SocSup_7	0.9795	0.0001		
	Support_Gen	0.9829	0.0001		

Structural model. After having checked that the measures behave appropriately for the overall data set, the structural model is evaluated. The adequacy of constructs in the structural model allows the evaluation of the explanatory power of the entire model as well as the estimation of the predictive power of the independent variables for both groups.

The explanatory power was examined by looking at the squared multiple correlations (R^2) of the dependent variables. A total of 35.3 per cent ($R^2 = 0.353$) in the overall sample of the variation of the construct "virtual social relationships" was explained by the six exogenous variables (i.e. the determinants of the formation of virtual social relationships), which was sufficiently high. Also the R^2 value for the dependent variable virtual social support ($R^2 = 0.619$) was high, explaining the 61.9 per cent variance of the variable. Predictive power was tested by examining the magnitude of the standardized parameter estimates between constructs together with the corresponding *t*-values. All path coefficients exceeded the recommended 0.2 level. Bootstrapping revealed strong or extremely strong significance (at the 0.01 resp. 0.001 level) of all path coefficients in the overall model. The analysis of the overall effect size (f^2) of the antecedents of virtual social relationship revealed that all constructs had a low effect except for the path coefficients motives of internet usage and perceived advantages which had a minor effect. The effect size for the path coefficient between virtual social relationship and virtual social support was high. Figure 2 depicts the structural model findings.

These findings support the hypotheses of our theoretical model at a general level of the overall data set (*H1-H5*).

Analysis and discussion of results
Results: virtual relationships of cancer patients
In order to understand whether cancer patients establish social bonds through online communities and if they do so, how are relationships cultivated, the participants in this study were first asked to identify up to three persons with whom they could talk about
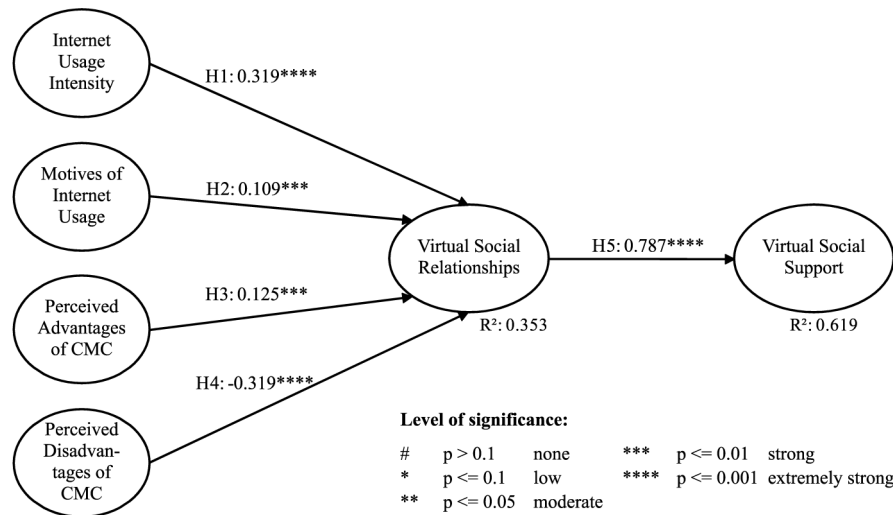

Figure 2.
VRSS structural model findings

their disease and who they got to know via a cancer-related online community. Second, they were asked which means of communication (online and/or offline) they used to cultivate the relationship.

The result showed that virtual relationships established to exchange thoughts about cancer were common among cancer patients using online communities. Of the respondents, 141 (46.8 per cent) described at least one virtual relationship, 60 participants (19.9 per cent) described a second virtual relationship and 22 (7.3 per cent) described a third one. These virtual relationships were described as well developed and close whereby questions measuring interdependence, depth of relationship and mutual commitment (Parks and Floyd, 1996) were used to measure the quality of a relationship. The information exchange between the cancer patient and his/her virtual relationship took place on a weekly (47 per cent) or a monthly basis (29 per cent). A majority of patients, 72 per cent, exchanged non-cancer-related information in addition to information about the disease.

Table VI shows that it is quite common that relationships established via online channels are transferred to the real world and cultivated through both virtual and non-virtual means of communication.

Results: determinants of virtual relationships

The data show that a majority of cancer patients using online communities developed virtual relationships. In the next step, we analyze factors, which influenced the establishment of a virtual relationship.

Intensity of internet usage (H1). Intensity of internet use of cancer patients had a very significant ($p < 0.001$) and strong effect ($\beta = 0.319$) on the development of virtual relationships. The measurement model revealed that neither generic internet usage nor internet usage intensity with regard to cancer-related topics were significant indicators. Only the type of internet usage was found to be a significant indicator ($p < 0.001$).

A possible explanation for the finding that both generic internet usage and the intensity of internet usage with regard to cancer-related topics are not significant might be that the willingness to have social interactions is not related to the time people spend online or the frequency of going online. Reasons for using the internet might also be of an information consumption nature rather than the interest in a social exchange. Very active internet users could perceive the internet as rather an information source instead of a channel for social interaction. Instead, the type of activity conducted online (active posting versus lurking) might capture the willingness to develop social relationships better. Willingness to interact, the perception of the

Means of communication	$N = 232$ (%) (all virtual relationships)	
Face-to-face meeting	38.6	
Via telephone	37.3	
Via e-mail	82.1	
Via letter	9.9	
Online forum	82.1	
Via chat	29.6	**Table VI.**
Other	4.0	Use of different interaction channels

internet as a medium beyond one-sided information search, as well as actual mutual online interaction with peers might be a potential prerequisite for the development of social relationships.

For shedding light into this, we additionally cross-tabulated the type of internet activity conducted with the development of virtual relationships. Patients actively using online interaction services (posters) were more likely to have virtual relationships than patients who only passively used them (lurkers) (chi-square test; $p < 0.001$). This is in contrast to findings of earlier studies on Lurkers and their existing sense of belonging to a community and having virtual relationships within VCs (Nonnecke and Preece, 1999, 2000, 2003).

Motives of internet usage (H2). Before considering the motives as a construct in the PLS model, the three motives of internet usage "interaction", "pass time", and "information seeking" were measured with 12 different questions. Principal-component analysis with varimax rotation was used to measure whether the 12 questions loaded on the expected three motives (eigenvalue = 1.0). Factors were retained on the basis of the "scree" plot and on the requirement that eigenvalue would be greater than 1.0. An item was retained if it had loadings exceeding 0.50 on a factor and no cross loadings exceeding 0.40. Of the original 12 questions, 11 were retained. They loaded as expected on the three motives defined previously by Papacharissi and Rubin (2000).

Looking at the PLS measurement model, three motives of internet usage, "pass time" (Amusement_M) was not a significant indicator and "information seeking" was only weakly significant ($p < 0.1$). In contrast, "interaction" was highly significant ($p < 0.001$). The overall effect of the construct "motives of internet usage" on the development of virtual relationships was significant ($p < 0.01$) but very low ($\beta = 0.109$). This supports the previous finding that patients actively using online interaction services (posters) are more likely to have virtual relationships than patients only passively using them (*H1*).

Perceived advantages computer-mediated communication in virtual communities (H3). All measured advantages and disadvantages of CMC in VCs were perceived as such by study respondents. We showed that there was a strongly significant ($p < 0.01$) but very weak ($\beta = 0.125$) positive effect of perceived advantages of CMC on the development of virtual relationships of cancer patients and therefore H3 remained valid since it cannot be rejected. The measurement model revealed that only the advantages location-independent usage ("I can use the internet independently from time of day") and the possibility to find peers in similar situations ("The internet allows me to find other people who had similar experiences") were significant indicators ($p < 0.05$ resp. $p < 0.01$). These indicators are therefore promising design parameters for communicating the advantages of VCs for patients and promoting their use.

Perceived disadvantages computer-mediated communication in virtual communities (H4). We hypothesized that the perceived disadvantages of CMC in VCs negatively influence the development of virtual relationships of cancer patients and the data confirmed this strongly ($\beta = -0.319$) and highly significant ($p < 0.001$). Analysis of the measurement model showed that only the following indicators were significant: "Other people are making remarks that don't have anything to do with the subject" ($p < 0.05$), "My conversation partners are not always accessible since they are not online all the time" ($p < 0.05$), and "The internet makes it difficult to establish personal relationships" (highly significant ($p < 0.001$)). Therefore, patients that perceived

establishing personal relationships over the internet to be difficult were less likely to develop virtual relationships. These findings can in return be used as design parameters for communication concepts for promoting VCs for patients. Even new functionalities such as matchmaking services among peers or visualisation of social networks among members of VCs in similar situations seem promising for overcoming these perceived disadvantages of CMC in VCs.

Results: virtual social support through virtual relationships
We hypothesized that virtual relationships in VCs would have a positive impact on virtual social support of cancer patients. Indeed, the structural model showed a very significant ($p < 0.001$) and very strong ($\beta = 0.787$) positive effect. The measurement model revealed that all indicators for the construct virtual social support were highly significant. These findings confirm previous research on the role of social relationships on social support (Dunkel-Schetter, 1984; Telch and Telch, 1986). Some studies have shown that social support plays a major role in positively influencing the well being of cancer patients (Cain *et al.*, 1986; Goodwin *et al.*, 2001; Telch and Telch, 1986; Dunkel-Schetter, 1984; Wright, 2002).

Social relationships of cancer patients have "the task" to provide this social support. To measure what kind of social support was provided by virtual relationships, the respondents were asked the open question "How does this person support you with regard to your disease?". Overall, "to listen" was the most frequently given answer to this. Some respondents emphasised that it was important that their conversation partner had had similar experiences. One respondent stated: "The person understands me, because the person was also affected by the disease. Somebody who never suffered from cancer does not understand me this way". Types of emotional support, like "understanding my situation", and "encouragement" were often mentioned. Furthermore, informational support by their virtual relationships was frequently listed by the respondents. In this study, virtual relationships were used mainly for passing on information and exchanging personal experiences. The respondents named "encouraging" and "cheering up" as important elements of emotional support. The most frequently named support of face-to-face relationships was "to be always there for me", comprising different forms of support and probably meaning support in general.

Limitations of the study
We recognize some study limitations, which are related to study design. Due to the ad hoc sampling technique, the results cannot necessarily be regarded as representative of the German cancer population. Compared to the cancer statistics for Germany this study has a younger population, probably due to the internet selection.

If there might be less need for emotional support outside existing social networks for older cancer patients, maybe due to the more stable family structure in this generation in Germany can only be speculated. Furthermore this sample is also slightly gender biased compared to the overall cancer-affected German population.

Second, we researched cancer patients who visited online communities; these patients are more likely than cancer patients who do not use online communities to establish virtual relationships. Further, the study tested cross effects of variables to a

limited extent and the collected data revealed many effects that could be analysed in greater detail.

Outlook for future research
While this research explored the role of virtual relationships in VCs for cancer patients and identified determinants for the development of virtual social relationships, future research should address potential intermediating variables underlying the formation of virtual relationships. More latent variables and constructs need to be taken into consideration as well as moderating or mediating variables between constructs. Additionally, our findings should be compared with those from other VCs (i.e. VCs for other life-threatening and non-life threatening diseases) and other cultures. Theory development is needed to gain insights on the systematic support of VCs. Given the diversity of communities in the internet and based on the results of this study, improvement in communication strategies of operators, functionalities for visualising social networks and matchmaking of patients are examples of topics which should be addressed in future research.

Conclusion
The objective of this study was to examine whether online communities meet their theoretical potential to provide an environment where social relationships can be established that help cancer patients to cope with their situation. The presented VRSS model explains antecedents of virtual relationships and their effect on perceived virtual support. This contributes to theory and the body of knowledge by integrating and extending existing models and theories as well as by proposing and testing it in a new area of application (Dibbern *et al.*, 2008).

We found that online communities provide a place where cancer patients can interact with other patients, exchange information, and establish social relationships that supplement their social network and that the newly formed virtual relationships play an important role in meeting the social needs of patients. Important determinants for the formation of virtual relationships within virtual communities for patients are general internet usage intensity (active posting vs lurking) and the perceived disadvantages of CMC in VCs. We also found that virtual relationships have a very strong effect on virtual support of patients, which explains why more than 61 per cent of the perceived social assistance of cancer patients is provided by cancer-related VCs. Emotional support and information exchange delivered through these virtual relationships in VCs can help patients to better cope with their illness.

Whether cancer patients using online communities seize this chance depends on different factors. We do know that virtual relationships among cancer patients are relatively common and that these relationships play a central role in meeting the social needs of patients. Particularly virtual relationships with other cancer patients are very important for providing informational and emotional support and thus help cancer patients to cope with their situation.

Virtual relationships do have boundaries. Like the perceived disadvantages of CMC show (wrong and misleading information), information from the internet generally has to be checked. Also, although virtual relationships offer informational and emotional types of support, they do not seem to offer practical types of support. Therefore, virtual relationships can complement real-life social relationships but they can hardly replace

them. Given the diversity of communities in the internet and based on the results of this study, especially how respondents in this study judged advantages and disadvantages of CMC, several possibilities for future improvement (e.g. communication strategies of operators, functionalities for visualising social networks and matchmaking of patients, etc.) emerge (Schweizer *et al.*, 2006) that need to be addressed in future research.

References

Abras, C. (2003), "Determining success in online education and health communities", unpublished PhD thesis, University of Maryland, Baltimore County, MD.

Bagozzi, R.P. (1979), "The role of measurement in theory construction and hypothesis testing: toward a holistic model", in Ferrell, O.C., Brown, S.W. and Lamb, C.W. (Eds), *Conceptual and Theoretical Developments in Marketing*, American Marketing Association, Chicago, IL.

Bagozzi, R.P. and YI, Y. (1988), "On the evaluation of structural equation models", *Journal of the Academy of Marketing Science*, Vol. 16, pp. 74-94.

Ballantine, P.W. and Martin, B.A.S. (2005), "Forming parasocial relationships in online communities", *Advances in Consumer Research*, Vol. 32, pp. 197-202.

Blanchard, A.L. and Markus, M.L. (2004), "The experienced 'sense' of a virtual community: characteristics and processes", *The Data Base for Advances in Information Systems*, Vol. 35, pp. 65-79.

Bortz, J. and Döring, N. (2005), *Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler*, Springer Medizin Verlag, Heidelberg.

Burkart, R. (1998), *Kommunikationswissenschaft – Grundlagen und Problemfelder – Umrisse einer interdisziplinären Wissenschaft*, Böhlau Verlag, Vienna.

Butler, B., Sproull, I., Kiesler, S. and Kraut, R. (2003), "Community effort in online groups: who does the work and why?", in Weisband, S. and Atwater, L. (Eds), *Leadership at a Distance*, Erlbaum, Mahwah, NJ.

Cain, E., Kohorn, E., Quinlan, D., Latimer, K. and Schwartz, P. (1986), "Psychosocial benefits of a cancer support group", *Cancer*, pp. 183-9.

Carmines, E.G. and Zeller, R.A. (1979), *Reliability and Validity Assessment*, Sage Publications, Beverly Hills, CA.

Carter, D. (2005), "Living in virtual communities: an ethnography of human relationships in cyberspace", *Information, Communication & Society*, Vol. 8, pp. 148-67.

Chin, W.W. (1998), "The partial least squares approach to structural equation modeling", in Marcoulides, G.A. (Ed.), *Modern Methods for Business Research*, Lawrence Erlbaum Associates, Mahwah, NJ.

Chin, W.W. (2000), *Frequently Asked Questions – Partial Least Squares and PLS-Graph*, available at: http://disc-nt.cba.uh.edu/chin/plsfaq.htm (accessed February 14, 2008).

Churchill, G. (1979), "A paradigm for developing better measures of marketing constructs", *Journal of Marketing*, Vol. 16, pp. 64-73.

Classen, C., Koopman, C., Angell, K. and Spiegel, D. (1996), "Coping styles associated with psychological adjustment to advanced breast cancer", *Health Psychology*, Vol. 15, pp. 434-7.

Cohen, J. (2003), *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*, Lawrence Erlbaum Associates, London.

Cummings, J.N., Butler, B. and Kraut, R. (2002), "The quality of online social relationships", *Communications of the ACM*, Vol. 45, pp. 103-8.

Dannecker, A. and Lechner, U. (2006), "Success factors of communities of patients", paper presented at the XIVth European Conference on Information Systems (ECIS), AIS, Gothenburg.

Dannecker, A. and Lechner, U. (2007), "Online and offline integration in virtual communities of patients – an empirical analysis", paper presented at the Third International Conference on Communities and Technologies, Michigan State University, East Lansing, MI.

Daum, M. (2005), *Virtuelle Communities für Krebspatienten*, Lohmar, Eul.

Diamantopoulos, A. and Siguaw, J.A. (2006), "Formative versus reflective indicators in organizational measure development: a comparison and empirical illustration", *British Journal of Management*, Vol. 17, pp. 263-82.

Diamantopoulos, A. and Winklhofer, H.M. (2001), "Index construction with formative indicators: an alternative to scale development", *Journal of Marketing Research*, Vol. 38, pp. 269-77.

Dibbern, J. and Chin, W.W. (2005), "Multi-group comparison: testing a PLS model on the sourcing of application software services across Germany and the USA. Using a permutation based algorithm", in Bliemel, F., Eggert, A., Fassott, G. and Henseler, J. (Eds), *Handbuch PLS-Pfadmodellierung – Methode, Anwendung, Praxisbeispiele*, Schäffer-Poeschel, Stuttgart.

Dibbern, J., Winkler, J. and Heinzl, A. (2008), "Explaining variations in client extra costs between software projects offshored to India", *MIS Quarterly*, special issue on Information Systems Offshoring, forthcoming.

Döring, N. (2003), *Sozialpsychologie des Internet: die Bedeutung des Internet für Kommunikationsprozesse, Identitäten, soziale Beziehungen und Gruppen*, Hogrefe, Göttingen.

Dunkel-Schetter, C. (1984), "Social support and cancer: findings based on patient interviews and their implications", *Journal of Social Issues*, Vol. 40, pp. 77-98.

Eriksson, E. (2001), "Caring for cancer patients: relatives' assessments of received care", *European Journal of Cancer Care*, Vol. 10, pp. 48-55.

Eysenbach, G., Powell, J., Englesakis, M., Rizo, C. and Stern, A. (2004), "Health related virtual communities and electronic support groups: systematic review of the effects of online peer-to-peer interactions", *BMJ*, Vol. 328, pp. 1166-70.

Fogel, J., Albert, S.M., Schnabel, F., Ditkoff, B.A. and Neugut, A.I. (2002), "Use of the internet by women with breast cancer", *Journal of Medical Internet Research*, Vol. 4.

Fornell, C. and Larcker, D.F. (1981), "Evaluating structural equation models with unobservable variables and measurement errors", *Journal of Marketing Research*, Vol. 18, pp. 39-50.

Fox, S. (2006), *Online Health Search*, in Project, P.I.A.L. (Ed.), Pew Foundation, Washington, DC.

Gefen, D. and Ridings, C. (2005), "If you spoke as she does, sir, instead of the way you do: a sociolinguistics perspective of gender differences in virtual communities", *Data Base*, Vol. 36, pp. 78-92.

Goodwin, P.J. *et al.*, (2001), "The effect of group psychosocial support on survival in metastatic breast cancer", *New England Journal of Medicine*, Vol. 345, pp. 1719-26.

Gustafson, D.H., Hawkins, R., Pingree, S., Mctavish, F., Arora, N.K., Mendenhall, J., Cella, D.F., Serlin, R., Apantaku, F., Stewart, J. and Salner, A. (2001), "Effect of computer support on younger women with breast cancer", *Journal of General Internal Medicine*, Vol. 16, pp. 435-45.

Haythornthwaite, C. (2002), "Strong, weak, and latent ties and the impact of new media", *Information Society*, Vol. 18, pp. 385-401.

Haythornthwaite, C. (2007), "Social networks and online community", in Joinson, A., Mckenna, K., Reips, U, and Postmes, T. (Eds), *Oxford Handbook of Internet Psychology*, Oxford University Press, Oxford.

Holland, K.D. and Holahan, C.K. (2003), "The relation of social support and coping to positive adaption to breast cancer", *Psychology and Health*, Vol. 18, pp. 15-29.

Huber, F., Herrmann, A., Meyer, F., Vogel, J. and Vollhardt, K. (2007), *Kausalmodellierung mit Partial Least Squares – Eine anwendungsorientierte Einführung*, Gabler, Wiesbaden.

Hughes, J. (1982), "Emotional reactions to the diagnosis and treatment of early breast cancer", *Journal of Psychosomatic Research*, Vol. 26, pp. 277-83.

Jarvis, C.B., Mackenzie, S.B. and Podsakoff, P.M. (2003), "A critical review of construct indicators and measurement model misspecification in marketing and consumer research", *Journal of Consumer Research*, Vol. 30, pp. 199-218.

Josefsson, U. (2002), "Internet as a healthcare resource. Patients' requirements for online community building", paper presented at IRIS 25, Bautahøj, Denmark.

Josefsson, U. (2003), *Patients' Online Communities Experiences of Emergent Swedish Self-help on the Internet*, Communities and Technologies, Amsterdam.

Josefsson, U. (2005), "Coping with illness online: the case of patients' online communities", *Information Society*, Vol. 21, pp. 133-53.

Katz, E. and Foulkes, D. (1962), "On the use of the mass media as 'escape': clarification of a concept", *Public Opinion Quarterly*, Vol. 26, pp. 377-88.

Klemm, P., Bunnell, D., Cullen, M., Soneji, R., Gibbons, P. and Holecek, A. (2003), "Online cancer support groups: a review of the research literature", *Computers, Informatics, Nursing*, Vol. 21, pp. 136-42.

Leimeister, J.M. and Krcmar, H. (2005a), "Acceptance and utility of a systematically designed virtual community for cancer patients", in Van den Besselaar, P., De Michelis, G., Preece, J. and Simone, C. (Eds), *Communities & Technologies*, Springer, Milan.

Leimeister, J.M. and Krcmar, H. (2005b), "Evaluation of a systematic design for a virtual patient community", *Journal of Computer-Mediated Communication*, Vol. 10.

Leimeister, J.M., Ebner, W. and Krcmar, H. (2005), "Design, implementation, and evaluation of trust-supporting components in virtual communities for patients", *Journal of Management Information Systems*, Vol. 21, pp. 101-35.

Leydon, G.M., Boulton, M., Moynihan, C., Jones, A., Mossman, J., Boudioni, M. and Mcpherson, K. (2000), "Cancer patients' information needs and information seeking behaviour: in depth interview study", *British Medical Journal*, Vol. 320, pp. 909-13.

Loader, B., Muncer, S., Burrows, R., Pleace, N. and Nettleton, S. (2002), "Medicine on the line? Computer-mediated social suppport and advice for people with diabetes", *International Journal of Social Welfare*, Vol. 11, pp. 53-65.

Maloney-Krichmar, D. and Preece, J. (2003), "Online communities: focusing on sociability and usability", in Jacko, J. and Sears, A. (Eds), *The Human-Computer Interaction Handbook: Fundamental, Evolving Technologies, and Emerging Applications*, Lawrence Erlbaum Associates, Mahwah, NJ.

Maloney-Krichmar, D. and Preece, J. (2005), "A multilevel analysis of sociability, usability, and community dynamics in an online health community", *ACM Transactions on Computer-Human Interaction (TOCHI)*, Vol. 12, pp. 201-31.

Manaszewicz, R., Williamson, K. and Mckemmish, S. (2002), "Breast cancer knowledge online: towards meeting the diverse information needs of the breast cancer Community", *Electronic Networking – Building Community*, Monash University, Melbourne.

Meric, F., Bernstam, E.V., Mirza, N.Q., Hunt, K.K., Ames, F.C., Ross, M.I., Kuerer, H.M., Pollock, R.E., Musen, M.A. and Singletary, E.S. (2002), "Breast cancer on the world wide web: cross sectional survey of quality of information and popularity of web sites", *BMJ*, Vol. 321, pp. 577-81.

Muncer, S., Loader, B., Burrows, R., Pleace, N. and Nettleton, S. (2000), "Forms and structure of newsgroups giving social support: a network approach", *Cyber Psychology & Behavior*, Vol. 3 No. 6, pp. 1017-29.

Myers, M. (1997), "Qualitative research in information systems", *MIS Quarterly*, Vol. 21, pp. 241-2.

Neal, L., Hansen, D., Lindgaard, G., Kogan, S., Leimeister, J.M., Oakley, K. and Selker, T. (2006), "Online health communities", paper presented at CHI 2006, ACM, Montreal.

Neal, L., Oakley, K., Lindgaard, G., Kaufman, D., Leimeister, J.M. and Selker, T. (2007), "Online health communities", paper presented at CHI 2007, ACM, San Jose, CA.

Nonnecke, B. and Preece, J. (1999), "Shedding light on lurkers in online communities", paper presented at Ethnographic Studies in Real and Virtual Environments: Inhabited Information Spaces and Connected Communities, Edinburgh.

Nonnecke, B. and Preece, J. (2000), "Lurker demographics: counting the silent", paper presented at ACM CHI 2000, The Hague.

Nonnecke, B. and Preece, J. (2003), "Silent participants: getting to know lurkers better", in Lueg, C. and Fisher, D. (Eds), *From Usenet to CoWebs: Interacting with Social Information Spaces*, Springer-Verlag, London.

Nonnecke, B., Preece, J. and Andrews, D. (2004), "What lurkers and posters think of each other", paper presented at 37th Hawaii International Conference on System Sciences (HICSS 37), IEEE Computer Society, Maui, HI.

Nunnally, J.C. (1978), *Psychometric Theory*, McGraw-Hill Book Company, New York, NY.

Nunnally, J.C. and Bernstein, I.H. (1994), *Psychometric Theory*, McGraw-Hill, New York, NY.

Papacharissi, Z. and Rubin, A.M. (2000), "Predictors of internet use", *Journal of Broadcasting & Electronic Media*, Vol. 44, pp. 175-96.

Parkhe, A., Wasserman, S. and Ralston, D.A. (2006), "New frontiers in network theory development", *Academy of Management Review*, Vol. 31, pp. 560-8.

Parks, M. and Roberts, L.D. (1998), "Making MOOsic: the development of personal relationships on line and a comparison to their off-line counterparts", *Journal of Social and Personal Relationships*, Vol. 15, pp. 517-37.

Parks, M.R. and Floyd, K. (1996), "Making friends in cyberspace", *Journal of Computer-mediated Communication*, Vol. 1, p. 16.

Peter, J. (1981), "Reliability: a review of psychometric basics and recent marketing practices", *Journal of Marketing Research*, Vol. 16, pp. 6-17.

Pratt, W., Unruh, K., Civan, A. and Skeels, M. (2006), "Personal information management: personal health information management", *Communications of the ACM*, Vol. 49, pp. 51-5.

Preece, J. (2000), *Online Communities –Designing Usability, Supporting Sociability*, John Wiley and Sons, Chichester, New York, NY, Weinheim, Brisbane, Singapore and Tokyo.

Preece, J., Nonnecke, B. and Andrews, D. (2004), "The top 5 reasons for lurking", *Computers in Human Behavior*, Vol. 20, pp. 201-23.

Reeves, P.M. (2000), "Coping in cyberspace: the impact of internet use on the ability of HIV-positive individuals to deal with their illness", *Journal of Health Communication*, Vol. 5, pp. 47-59, supplement.

Rheingold, H. (2000), *The Virtual Community – Homesteading on the Electronic Frontier*, rev ed., MIT Press, Cambridge, MA.

Ridings, C.M., Gefen, D. and Arinze, B. (2002), "Some antecedents and effects of trust in virtual communities", *Journal of Strategic Information Systems*, Vol. 11, pp. 271-95.

Rossiter, J. (2002), "The C-OAR-SE procedure for scale development in marketing", *International Journal of Research in Marketing*, Vol. 19, pp. 305-35.

Rosson, M.B. (1999), "I get by with a little help from my cyber-friends: sharing stories of good and bad times on the web", *Journal of Computer-mediated Communication*, Vol. 4, pp. 1-21.

Samarel, N., Tulman, L. and Fawcett, J. (2002), "Effects of two types of social support and education to early-stage breast cancer", *Research in Nursing & Health*, Vol. 25, pp. 459-70.

Satterlund, M.J., Mccaul, K.D. and Sandgren, A.K. (2003), "Information gathering over time by breast cancer patients", *Journal of Medical Internet Research*, Vol. 5 No. 3, p. e15.

Schweizer, K., Leimeister, J.M. and Krcmar, H. (2006), "The role of virtual communities for the social network of cancer patients", paper presented at Americas Conference on Information Systems (AMCIS 2006), AIS, Acapulco.

Seltin, N. and Keeves, J.P. (1994), "Path analysis with latent variables", in Husen, T. and Postlethwaite, T.N. (Eds), *International Encyclopedia of Education*, Oxford.

Sloper, P. (2000), "Experiences and support needs of siblings of children with cancer", *Health and Social Care in the Community*, Vol. 8, pp. 298-306.

Spadaro, R. (2003), *Eurobarometer 58.0: European Union Citizens and Sources of Information about Health*, European Opinion Research Group (EORG), Belgium.

Taylor, E. (2003), "Spiritual needs of patients with cancer and family caregivers", *Cancer Nursing*, Vol. 26, pp. 260-6.

Telch, C.F. and Telch, M.J. (1986), "Group coping skills instruction and supportive group therapy for cancer patients: a comparison of strategies", *Journal of Consulting and Clinical Psychology*, Vol. 54, pp. 802-8.

Turner, J.W., Grube, J.A. and Meyers, J. (2001), "Developing optimal match within communities: an exploration of CMC support communities and traditional support", *Journal of Communication*, Vol. 51, pp. 231-51.

Van Eimeren, B. and Frees, B. (2007), "Internetnutzung zwischen Pragmatismus und YouTube-Euphorie", *Media Perspektiven*, Vol. 8, pp. 362-78.

Wellman, B. and Gulia, M. (2001), "Virtual communities as communities – net surfers don't ride alone", in Smith, M.A. and Kollock, P. (Eds), *Communities in Cyberspace*, Routledge, New York, NY.

Wold, H. (1985), *Partial Least Squares*, Wiley, New York, NY.

Wright, K. (1999), "Computer-mediated support groups: an examination of relationships among social support, perceived stress, and coping strategies", *Communication Quarterly*, Vol. 47, pp. 402-14.

Wright, K. (2000a), "The communication of social support within an on-line community for older adults: a qualitative analysis of the SeniorNet community", *Qualitative Research Reports in Communication*, Vol. 1, pp. 33-43.

Wright, K. (2000b), "Perceptions of on-line support providers: an examination of perceived homophily, source credibility, communication and social support within on-line support groups", *Communication Quarterly*, Vol. 48, pp. 44-59.

Wright, K. (2002), "Social support within an on-line cancer community: an assessment of emotional support, perceptions of advantages and disadvantages, and motives for using the community from a communication perspective", *Journal of Applied Communication Research*, Vol. 30, pp. 195-209.

Wright, K. and Bell, S.B. (2003), "Health-related support groups on the internet: linking empirical findings to social support and computer-mediated communication theory", *Journal of Health Psychology*, Vol. 8, pp. 39-55.

Further reading

Parks, M.R. and Roberts, L.D. (1997), "'Making MOOsic': the development of personal relationships on-line and a comparison to their off-line counterparts", *Proceedings of the Annual Conference of the Western Speech Communication Association, Monterey, CA*.

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