2006

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Abstract

This paper presents results of an empirical study regarding success factors of virtual communities of patients. These success factors capture what is important to members of virtual communities of patients and the interconnections between these aspects. We analyze the possible impact of success factors that we identify to the design and implementation of e-services as part of the business model for virtual communities of patients. We analyze what is of major interest to members of virtual communities of patients and the expectations of consumers of health related content on the Internet. This paper focuses on virtual communities of patients. Recommendations for new e-services are being discussed.

Keywords: Virtual Community, Health Care, Business Model, Success Factors

1 INTRODUCTION

Health related information on the Internet is gaining more and more popularity. For example, the number of groups that care about health related topics are listed on Yahoo has nearly doubled in the past 12 months from 40,000 in August 2004 (Dannecker and Lechner 2004) to 74,000 in May 2005 (Yahoo 2005). The players in the e-health sector and their business models differentiate themselves. E-health with its new players and its novel e-health services are still considered to be a rapidly evolving sector. The reasons are manifold: the need to cut costs, the increasing use of digital media to support processes in the health care sector and new medical paradigms such as evidence based medicine.

Virtual communities in health care (VCHC, also mentioned as virtual communities of patients) have a relatively long tradition as they were among the first virtual communities to emerge. Scientific and popular literature on virtual communities refers to various examples of VCHC as examples for innovative business models with great potential (Rheingold 1994; Hagel III and Armstrong 1997). These VCHC typically provide information concerning diseases to their members and the mutual support of community members is the value added. Examples of successful virtual communities include: communities of cancer patients, women's communities of breast cancer patients, and communities of patients with chronic illnesses (e.g. (Josefsson 2004; Leimeister, Daum et al. 2004)). We observe that little has changed within this kind of community over the past few years. The number of communities and the number of visitors and members have increased, but these communities are still concerned mainly with providing information and are a place for mutual support (Dannecker and Lechner 2004). These communities are invaluable for their members and an important source of information for patients.

Some business models in the e-health sector might be a threat for virtual communities. The number of sites offering health related information continues, such as sites that offer professional medical advice services (e.g., netdoctor.com) or sites that handle medical data and support various processes in that field. What does this mean for VCHC and the business model? Is it possible to enhance the business model virtual community in its two core functions (1) providing information and (2) providing mutual support?

This paper contributes an analysis of the business model of VCHC. This paper presents results of an empirical study of the VCHC sector of Germany, Austria and the German speaking part of Switzerland. The following factors are considered success factors of VCHC: design aspects in technology, processes and interaction, including interaction in the social network, and values that can be influenced by design. We analyze the factors that are important, the interconnections between factors, clusters of aspects, and the impact of these aspects on the design of e-services.

2 STATE OF THE ART

The first part of the section constitutes an analysis of the developments in the e-health care sector and the competitors of VCHC. The second part reviews the literature on virtual communities, and the interconnections and dependencies of different aspects of virtual communities.

2.1 Content driven e-health business models

The market for health related information and services are evolving. As we focus on the German speaking market, we provide an overview of the current situation of demand for health related information in Germany. About 30% of all Germans that are online (that means about 10.3 million people) regularly visit online health care websites (Nielsen//NetRatings 2004). The growth of users visiting online health care websites has expanded by 38% from the third quarter (Q3) 2003 to Q3/2004. Besides that, the number of pages visited have increased by 119% from Q3/2003 to Q3/2004

(Nielsen//NetRatings 2004). A study of 154 organizations in the market for health related information and services in May 2005 revealed that there are at least six e-health business models with major players, for which providing health related information is an important part of the business model.

(1)   Internet service providers. For example, T-Online and AOL, in Germany offer as part of their portals health related topics (e.g. T-Online onGesundheit 1,901,000 Unique Audience (UA) Q3/04 and AOL Health 1,391,000 UA/Q3/04 (Nielsen//NetRatings 2004)). The health related information offered on these sites covers a wide spectrum, and aims at a large audience with general interest.

(2)   Specialized companies for health related topics. Examples include NetDoctor with 1,425,000 UA/Q3/04, Medicine Worldwide 1,134,000 UA/Q3/04, @med1 647,000 UA/Q3/04 and MedizInfo 507,000 UA/Q3/04). These companies cover a wide spectrum of topics. They offer services such as "Ask the Expert" that allows a user to ask a health specific question to an expert, typically a physician. These services are priced around 30 € per question; the answers are sometimes collected on the site.

(3)   The company BSMO (587,000 UA/Q3/04) provides health-specific communication services for the pharmaceutical industry sector and claims to edit the content and provide technical support. BSMO offers a Call-Center related to health care topics for physicians and patients. Typical questions by physicians or patients to the Call-Centers include side effects or contraindication of medicine.

(4)   Health management with customized information services. Those sites cover diets, health issues and wellness related information. The most popular companies in Germany in this sector are Natural Weight Program (608,000 UA/Q3/04) and Weight Watchers (483,000 UA/Q3/04).

(5)   Internet pharmacies. 0800DocMorris (1,103,000 UA/Q3/04) is the biggest Internet pharmacy. It offers a range of information about medicine, e.g. information on use, contraindication and ingredients. It is one of the most upcoming sites. In the past few years, the number of UA has nearly doubled in the past twelve months.

(6)   Virtual communities in the health care sector offer a means to interact and typically offer health-related content. This content can be contributed by community members or community operators. This can include content developed by medics as well as content developed by patients or relatives without formal qualification. Typically, these communities are organized by patients or relatives. The mutual support of community members is the key value proposition of VCHC and some of these communities are affiliated with organizations of patients. The business model of these communities is typically rudimentary: subscription fees and banner advertising are the main sources of income and many communities are run by volunteers with altruistic motivations.

Note that all of the business models provide health related information while the revenues are generated by other means or that health related information "just" supports a business model with an entirely different objective. Services like "Ask an expert" and "Ask a doctor" are the main services that complement the online information. For example the mutual support of VCHC seems to be a distinguishing feature. Let us analyze the literature in this field.

2.2   Virtual Communities in Scientific Literature

In literature, functions that can be taken over by a community within the value-added chain are discussed. Examples for such functions are marketing, quality assurance, after-sales support and innovation (for an overview see (Lechner 2002)). Communities meet the need of social interaction and the focus of the business has to adapt to that interaction (Levine, Locke et al. 2000).

Let us look at what defines the online world of virtual communities. The contributions of members distinguish virtual communities from other organizations or business models in the digital economy (Timmers 1998). Members contribute information and develop an atmosphere of trust which is prerequisite for collaboration or complex transactions (McKnight, Choudhury et al. 2002). Knowledge contribution and sharing is a complex and social process that involves different actors that have different needs and goals (McLure Wasko and Faraj 2005).

Rheingold describes how this social network emerges. He defines a virtual community as a "social aggregation" that emerges in cyberspace when enough people carry on discussions long enough, with human feeling, to form "webs" of personal relationships (Rheingold 1994). Virtual communities are characterized by rules of interaction, value system, mutual trust, common goals and interests (Whittaker and O`Day 1997; Figallo 1998; Schubert 1999; Preece 2000; Wellmann 2001). Leimeister et al. have developed a ranking of technological, organizational and social success factors for virtual communities in general (Leimeister, Sidiras et al. 2004).

The contributions of community members and the social network are the distinguishing properties of the business model. Hagel and Armstrong identified four key feedback effects as drivers (dynamics of increasing returns) for community success. These feedback effects enhance content attractiveness, customer loyalty, transaction offerings and member profiles (Hagel III and Armstrong 1997). A process of community building is described (Gongla and Rizzuto 2001) and the changing purpose of communities in the stages of development and various characteristics of knowledge sharing communities (Andriessen 2005). Communities have their development cycles and so do individual community members (cf. for roles in online gaming (Skageby and Pargmann 2005). The variety of roles in a community (several kinds of helpers, administrators, professionals…) and the importance of these roles are studied for an online chess gaming community (Ginsburg and Weisband 2004).

The success of virtual communities is typically measured by indicators like number of members and frequency of interaction, growth, and, in particular, even distribution of contributions, regular and long term participation, distribution of active and passive members (lurkers), evaluation of contributions, number of threads and number of contributions within the threads, intensity of online interaction, organisation and system of roles (Schoberth, Preece et al. 2003; Ginsburg and Weisband 2004; Josefsson 2004; Leimeister, Sidiras et al. 2004). Components on how to design, implement and evaluate trust-supporting in VCHC are analyzed (Leimeister, Ebner et al. 2005). Leimeister's et al. work shows how perceived competence and perceived goodwill of the operator and of the other members influence the trust from a member's perspective into the VCHC (system trust, e.g. content available) and the member contributions (interpersonal trust). Leimeister et al. have developed a ranking of success factors based on a study with experts and operators of virtual communities in general (Leimeister, Sidiras et al. 2004). The factors include technological, social, and organizational aspects. Note that these success factors are different from the ones in this study.

Other important factors within virtual communities are social aspects. In social profiles the existence and use of services can be grouped within four dimensions (Hummel and Lechner 2002). Based on Hamman (Hamman 2003) a virtual community can be characterized by: (1) a group of actors, (2) (social) interaction, (3) bonding between the actors and other members of the community and (4) the common place. Particular to the field of virtual communities is the degree of differentiation. While contributions by members and social relations are keys for almost all communities, communities differentiate themselves in interaction, and the use of e-services (Hummel and Lechner 2002). Moreover, the nature of the illness leads to differentiation in e-service usage within VCHC as well as (Dannecker and Lechner 2004) in terms of what is allowed to discuss, what is in the main focus of the members and what is the main motivation of the operators.

3   RESEARCH METHOD

A questionnaire was adapted from the empirical study of Leimeister et al. (Leimeister, Sidiras et al. 2004), which addressed virtual communities in general to the needs of VCHC in several ways. The model of social profiles (Hummel and Lechner 2002) illustrates that bonding, and services which support bonding, are important to virtual communities. Interviews with operators of VCHC also confirmed that from the operator point of view bonding and mutual support is of importance to members. Accordingly, the questionnaire was extended to include questions concerning the social relations between community members and the community itself.

A study of VCHC and service use of VCHC (Dannecker and Lechner 2004) illustrates that there are differences in the type of medical content that is available within VCHC. It also showed that the type of member contributions in terms of what is discussed and the way it is discussed (e.g. are discussions about alternative methods of treatments or discussions about medical institutions allowed) differs from non-existing to regularly used. It also showed that different kinds of e-services are available, e.g. e-services like ask the expert (doctor). The questionnaire includes several questions concerning different kinds of medical content, member contributions of medical content and e-services.

Open interviews with operators and members of VCHC pointed out that the interconnection between self-help groups (meetings in the real world) and the VCHC is unclear but that offline and online worlds are connected through people and different media. Therefore, a section in the questionnaire about the self-help groups and the connection between the real world and the VCHC was included. In interviews, operators claimed that neutrality (e.g. not being sponsored by the pharmaceutical industry) is essential from their members' perspectives. This restricts the development of sources of revenues for VCHC and questions concerning the validation of this claim of community operators were included. The study of VCHC (Dannecker and Lechner 2004) indicated differences in the way relatives are integrated within the VCHC and it is important that the majority of VCHC members is affected by the disease the VCHC cares about. We included questions on the integration of relatives and medics. Questions in the questionnaire of Leimeister that do not fit the special target group of VCHC were eliminated.

The questionnaire consists of four main parts. The first part looks at demographic aspects (age, gender etc.), the second part contains questions concerning the illness, the third part deals with the interconnection of the real and online world, and the fourth part consists of questions concerning e-services and social networks. The fourth part is comprised of questions concerning medical content, quality assurance methods based on members contributions and operators contributions, aspects of the operators role, aspects handling technical issues (ease of use), aspects on interaction possibilities, and aspects that cover bonding. In total, the forth part consists of 34 questions. Following the empirical study of Leimeister et al. (Leimeister, Sidiras et al. 2004) a bipolar verbal ordinal scale was used for the questions (starting with "Important is…") of this part so that statements were to be accepted or rejected.

Two versions of the questionnaire were created: one for the members and one for the operators of the VCHC. We refer to operators as the people who manage and provide the platform. Typically, those people are identified on the platform and they consider themselves to be members of the community. The view of the operator is important as well, to figure out if there are differences in the views of operators and members that could have impacts to further developments of VCHC.

We identified VCHC in the German speaking context based on an Internet research done on Yahoo and Google. Cross linked sites in the context of VCHC were also taken into consideration. 250 VCHC in the German speaking context were identified. VCHC with less than 50 members and communities with the most recent contribution older than one year were discarded. This led to 117 VCHC from which 73 (63%) were chosen randomly and the ten VCHC to which the first version of the questionnaire was sent were added to the sample too.

The questionnaire was sent to the operators of VCHC with the request to support the study and to provide a link to the questionnaire to their members and to fill out the operator version of the questionnaire. The questionnaire was available on the Internet for three weeks in June 2005. After eliminating all empty entries and duplicate entries (same values and session id), 295 entries of members and 21 entries of operators formed the sample. For interpretation and validation of quantitative results, qualitative interviews with operators and members as well as two presentations with the management team of two VCHC have been done.

4 DEMOGRAPHIC DATA AND GENERAL RESULTS

People participating in this study are active in a total of 145 different VCHC. Each member and operator is active in at least one of the VCHC that we have sent the questionnaire to. Because we have asked for all the VCHC they are active in, some survey participants mentioned more than one VCHC. 50% of the participants are members of the "Top Ten" most popular VCHC. 16 communities are associated with two members and 100 communities are associated with one member. More than 95% of the members are affected by chronic diseases. The five most popular VCHC are listed in Tab. 1:

	VCHC	Number of participants	Ratio
1	rheuma-online.de (rheumatism)	50	11.74%
2	fibromyalgie-aktuell.de (pain patients)	35	8.22%
3	dccv.de (morbus crohn / colitis ulcerosa)	31	7.28%
4	croehnchen-klub.de (morbus crohn / colitis ulcerosa)	24	5.59%
5	sylvia.at (morbus crohn / colitis ulcerosa)	15	3.50%

Table 1.   Top Five of the VCHC according to number of study participants

The research sample ($N_{members}$ = 295, $N_{operators}$ = 21) consists of 69% female and 31% male members. This rather interesting quote is also reflected by the quotes of participants within VCHC given by the operators in follow up interviews. Shown below in Tab. 2 are the characteristics and general results separated by the operators´ and members´ views.

	Members	Operators
Gender f / m	208 / 87	10 / 11
Average age	41.68	40.52
Time online (h / day)	3.26	6.58
Time in VCHC (h / day)	0.87	3.59
Be part of VCHC	1.50	1.38
Member since (years)	4.15	6.26
Are you affected by the illness?	yes 281 / no 14	yes 11 / no 10
Time of illness (years)	9.89	6.95
Ever used a service in the Internet like "Ask the Expert"?	yes 80 / no 215	yes 7 / no 14
Do you join meetings of self-help groups (SHG) (very often 1 – never 5)	yes 154 / no 141 (4.01)	yes 16 / no 5 (3.86)
Where do you feel more comfortable? VCHC / the same / SHG	115 / 159 / 21	9 / 11 / 1
How often do you write articles within the forum? (several times a day 1 – weekly 3 – never 5)	3.12	2.19
Do you know other members in real life?	yes 136 / no 159	yes 14 / no 7
Does the VCHC play a central role within your life? (highly agree 1 – highly disagree 5)	2.38	1.81
Satisfaction with the evolution of your VCHC? (very satisfied 1 – completely disappointed 5)	1.96	1.71
Do you ask questions within the community you won't ask a physician? (very often 1 – never 5)	3.06	3.00

Table 2.   Demographic characteristics and general result of participants

The average age is over 40 years old which is higher in comparison with other Internet surveys. The average time of membership is 4.15 years which is very high, e.g. in comparison with the study of Leimeister et al. (Leimeister, Ebner et al. 2005) where 25% of the membership period was less than 1 month (4.6% our study), 12.5% between 1-3 months (5.3%), 12.5% between 4-6 months (9.6%) and 50% longer than 6 months (80.5%). About 50% of the female members know other members of the VCHC in real life whereas only 30% of the male members do. For the female members (2.98) it is more important to ask questions they would not ask physicians than it is for male members (3.25). The average rate of satisfaction with the progress of their VCHC is 1.96 .

5 ANALYSIS

An explorative factor analysis based on the members was executed to find evidence of convergent and discriminated validity. Table 3 summarizes the factor loadings for varimax orthogonal seven-factor solution using a principal components analysis. All cronbach-alpha values (see Table 3) for each measure of the estimated values show that the reliability of the construct is within an acceptable range.

The total explained variance is 70 percent. Each item with a factor load less than .50 or loaded on another factor greater than .40 were suppressed. 27 of 34 questions (80%) are part of the analysis.

	Factor loads						
	O	B	EoU	M	QAO	I	QAC
Cronbach-Alpha	.823	.746	.774	.712	.653	.768	.824
Continuous community-controlling with regard to number of members (O1)	.878						
Continuous community-controlling with regard to the frequency of visits (O2)	.861						
Continuous community-controlling with regard to member satisfaction (O3)	.624						
Special treatment of loyal members (O4)	.577						
Appreciation of contributions of members by the operator (O5)	.509						
Does the VCHC play a central role within your life (B1)		.754					
Satisfaction with the progress of your VCHC (B2)		.698					
The feeling to be in a place at home (B3)		.686					
That people understand you with your problems (B4)		.565					
Do you ask questions within the community you won't ask a physician (B5)		.550					
Do you write articles within the forum (B6)		.515					
Fast reaction time of the website (EoU 1)			.802				
Stability of the website (EoU 2)			.787				
Intuitive user guidance (EoU 3)			.727				
High number of members within a short term (EoU4)			.589				
Participation in online based medical trials (M1)				.766			
Push of research within the field of your disease (M2)				.651			
That physicians respect the content and statements of the community (M3)				.632			
Offering up-to-date and relevant clinical trials (M4)				.630			
Existence of an umbrella organization of patients (QAO1)					.639		
Building trust among the members by rating the contributions (QAO2)					.598		
Moderation of member contributions by the operator (QAO3)					.504		
Supporting the community by regular real-world meetings (I1)						.695	
Arranging regular events (I2)						.689	
Statements of the community about medical institutions (QAC1)							.887
Statements of the community about physicians (QAC2)							.861
Possibility of discussions about alternative methods of treatment (QAC3)							.655

Table 3.   Summary of factor loadings for varimax orthogonal seven-factor solution

Component	Description
Perceived Operator Role (O)	Describes the role of the operator from a member perspective.
Perceived Bonding (B)	Describes how important the bonding between members and the VCHC and the social context between the members is.
Perceived Ease of Use (EoU)	Describes how easy the use of the information technology is from a member perspective.
Perceived Medical Aspects (M)	Describes medical aspects in terms of medical content and the research areas the members of the VCHC are interested in.
Perceived Quality Assurance by the operator (QAO)	Describes the quality assurance actions done by the operator.
Perceived Interaction (I)	Describes the types of interaction within the VCHC.
Perceived Quality Assurance by the community (QAC)	Describes the quality assurance actions done by the members.

Table 4.   Components of the research model

Reflecting the results of the factor analysis (Tab. 3) seven components are defined in Tab. 4. The components followed, a structural equation model was estimated by AMOS 5 (Byrne 2001) using a maximum likelihood estimation (members only). The values of the model are within an acceptable range (RMSEA = .033). All standardized regression coefficients are significant at p < .001 (beside QAO->B p = .009 and O->B p = .002). In Fig. 1 only the latent variables are shown.
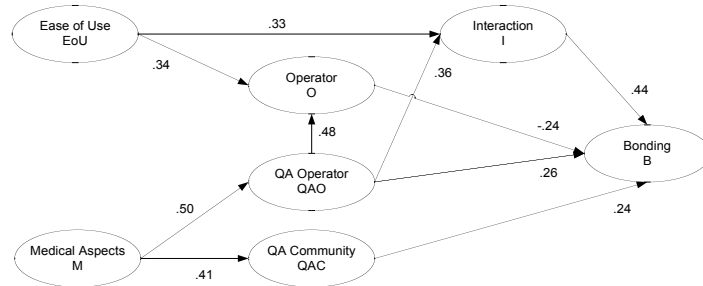

Figure 1.   Structural equation model (members only)

Let us explain this model and relate it to examples and theory. All latent variables lead to the latent endogenous variable Bonding (B). Bonding, i.e., the social relations among community members and between community members and the community and the community site distinguish the business model community (Hagel III and Armstrong 1997; Schubert 1999; Hummel and Lechner 2002). Interaction strengthens these social relations and this is reflected by the model as the direct effect of Interaction (I) to B is the strongest.

The availability of medical information (M) on the site influences B only indirectly via quality assurance of medical information by the community (QAC) and quality assurance of medical information by the operator (QAO). Note that this indirect effect (.25) is as strong as the one of QAO, QAC and role of the operator (O) inversely. Let us compare this with reality and literature. The typical community site architecture features an "information only" area and little means for interaction with little relation between these two parts. In practice, the two parts do not benefit from each other and could very well exist on different sites.

It is the interconnection between community and information, the process of establishing a common understanding of the field of interest, a common body of knowledge, trust and common values that distinguishes a community (Hagel III and Armstrong 1997; Preece 2000; Hummel and Lechner 2002).

Quality assurance methods by the community are one way to establish this common understanding, these values and norms based on a collection of medical content, e.g., research reports, scientific articles and popular information. Comments, recommendations, ratings, ratings of ratings or reviews are means to implement this quality assurance in communities. VCHC typically have a common opinion about, e.g., preferred treatments and alternative medicine. The community is a kind of filter which helps to select the pieces of information which fit the common opinion or to translate pieces of information from scientific articles so that it can be understood by the community (Dannecker and Lechner 2004). This applies typically to chronic diseases where there is little means to measure the success of treatments and where there are few objective measures for the individual state of the disease (Dannecker and Lechner 2006).

Also, the role of the operator in quality assurance (QAO) is important and strengthens the bonding. Again, this is reflected by literature as the community and the operator need a common understanding of the field of interest. In practice, providing relevant information is the role of a community operator. The role of operators who typically control a community in terms of member satisfaction, member interaction, and growth (latent variable O) is not beneficial for the community. Several authors describe that communities do not want controlling and operators that invest heavily in community controlling (instead of investing in content) are assumed to have a more commercial interest in the community (Hagel III and Armstrong 1997).

Interaction, e.g., online and offline events (I) strengthen bonding and ease of use (availability, reaction time and usability of the web site of the community) are prerequisite for good interaction. Again this is mirrored by the path EoU->I->B in Fig.1. An operator that promotes interaction, e.g., through special events, can benefit from good medical content (M) and strengthen the bonding of the community (M->QAO->I->B in Fig. 1).

This model captures how bonding, the distinguishing feature of a community, is affected. However, to determine which services should be available and should be designed, more analysis is needed based on the views of members and operators as well as an analysis of the most important features that can be found within the model.

6 THE VIEW OF MEMBERS AND OPERATORS

It is of special interest to examine whether the ideas of the operators match those that are important to VCHC members. We list the most important factors ordered by the member perspective in Fig. 2. The figure presents an abbreviated version of the original question together with the arithmetic mean of the answers. The sample was tested for normal distribution using an exact "Kolmogorov-Smirnov-Test" and all results are significant with $p<.001$. As expected, handling member data is the most important factor for the members whereas it is considered even more important by the operators. The feeling of being understood with problems within the VCHC is next, followed by the assistance of new members by experienced members. Note that the list of top important factors contains technical issues like the stability of the web site, social issues like the feeling of being understood or feeling at home in the VCHC. Figure 2 shows the top 17 of 34 important factors based on the members' perspective. All the listed factors are part of the questionnaire in the survey. Note that six important factors concerning medical issues are of special interest. These factors are: physicians respect the content and statements of the community, push of research, statements about medical institutions and physicians, possibility to discuss alternative methods of treatments and offering up-to-date and relevant clinical studies.
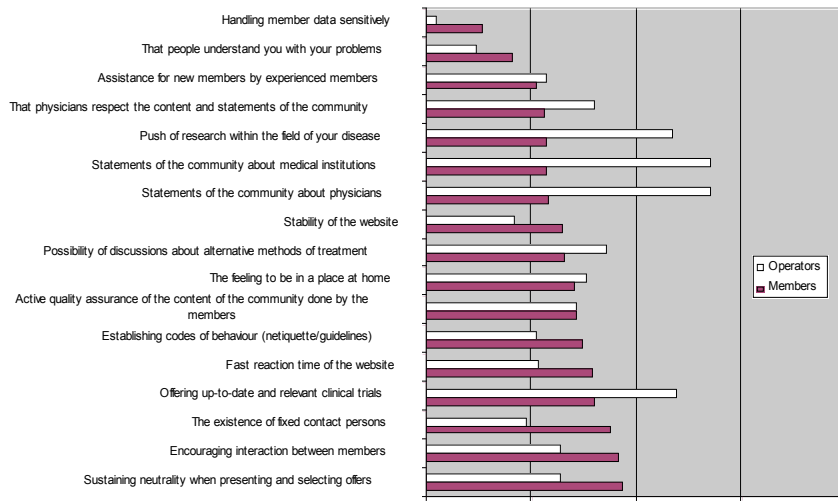

Figure 2.   Important Factors ordered by members' view (highly agree 1 – highly disagree 5)

Let us relate these factors to our research model (Fig. 1). The factors which give statements about medics, clinical institutions and the possibility to discuss alternative methods of treatments are quite important factors to the members of VCHC. These factors are part of the quality assurance section of the community (QAC) within the previously introduced model (Fig. 1). Second, the factors "physicians should respect the contributions of the community", the "push of research within the addressed field of health relevant topics" and the "offering of up-to-date and relevant clinical trials" are also of

special interest to the members of VCHC. These factors address the medical part (M) within the previously introduced model (Fig. 1)

7 DETAILED COMPONENT ANALYSIS

As previously mentioned there are differences between the view of members and the view of the operators. Besides the fact that there is a gap between the views of members and operators, it is necessary to take a closer look at the different aspects of the model. In Table 6 the components of the previously introduced model (Fig. 1) and their variables are listed with their means (regarding the importance of the factors). The importance of the factors (variables) range from "highly agree" 1 – "highly disagree" 5. Values of the members' views between 1.0 and 2.0 and differences greater than .5 are highlighted in grey in Tab. 5.

The first column shows the components of the model followed by the components' variables in the second column. These variables represent the important factors that are part of the questionnaire of the empirical study. Columns three and four show the means separated by the view of the operator and the views of the members. The fifth column represents the absolute difference of the means of the operators and members. The greater the value in the fifth column the greater the gap is between the view of the operator and the members by means of over- or underestimating this important factor. In the last column the totals of the differences and the total per variable is shown.

Components	Variables	Means - View of		Difference	
		Operators	Members	Variable	Total (Total / # Variables)
Operator (O)	O1	2.7619	2.8361	0.0742	0.5832 (0.1166)
	O2	2.9048	2.8978	0.0070	
	O3	2.0000	2.1562	0.1562	
	O4	3.5000	3.4694	0.0306	
	O5	3.3000	2.9847	0.3153	
Bonding (B)	B1	1.8095	2.3817	0.5721	1.1036 (0.2207)
	B2	1.7143	1.9574	0.2431	
	B3	1.7619	1.7043	0.0576	
	B4	1.2381	1.4081	0.1700	
	B5	2.9979	3.0586	0.0607	
Ease of Use (EoU)	EoU1	1.5263	1.7914	0.2650	1.0449 (0.2612)
	EoU2	1.4211	1.6471	0.2260	
	EoU3	1.6842	2.0109	0.3267	
	EoU4	2.1905	2.4176	0.2271	
Medical Aspects (M)	M1	2.1111	2.0774	0.0337	**1.2622 (0.3156)**
	M2	2.1667	1.5706	0.5961	
	M3	1.8000	1.5558	0.2442	
	M4	2.1905	1.8022	0.3882	
QA Operator (QAO)	QAO1	3.5500	2.6959	0.8541	**1.4569 (0.4856)**
	QAO2	2.6667	2.4475	0.2192	
	QAO3	2.5238	2.1402	0.3836	
Interaction (I)	I1	2.5789	2.4992	0.0797	0.2048 (0.1024)
	I2	2.3000	2.1749	0.1251	
QA Community (QAC)	QAC1	2.3500	1.5717	0.7783	**1.7612 (0.5871)**
	QAC2	2.3500	1.5739	0.7761	
	QAC3	1.8571	1.6504	0.2068	

Table 5.   Means of important factors clustered by the components (all means p<.001)

The bold entries in the last column indicate that the total amount of difference is greater than 1.0 and the total difference per each variable is greater than 0.3 which indicate a gap due to the members´ and

operators´ views regarding the components. Two major aspects are now possible to figure out. First, in which components are the most important factors from the members' perspectives. Second, in which components are the largest gaps between the views of the operators and the views of the members. The first step of the analysis is the importance of the factors within the components (Tab. 3) from a member's perspective. The second step analyses the gap between the view of the operators and members regarding the important factors. In the last step, both aspects are taken into consideration together. Following the results (Tab. 5) four different components are highly important to the members as reflected by the important factor (Fig. 2). These components are B, EoU, M and QAC. The most underestimated important factors are within the components B (1 important factor), M (1), QAO (1) and QAC (2). After viewing the totals of the components, the largest gaps between the members´ and operators´ views are within the components M, QAO and QAC. Taking these aspects into consideration the operator should pay specific attention to the components M and QAC due to the importance it has to the members which is reflected in the gaps between the two groups.
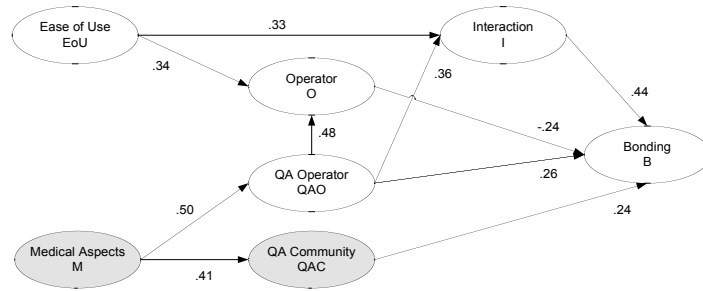

Figure 3.   Structural equation model (members only) focused on the needs of the members

These results are shown in Fig. 3 highlighted in grey. To bring a VCHC closer to the needs of members of such communities, e-services should be aware of the aspects M and QAC. Currently e-services that are able to cover such aspects are not available within VCHC or in any other companies handling health related aspects. The reason for this might differ, starting with the lack of awareness of its members' needs in VCHC or possible legal restrictions on operators of VCHC to handle content about the quality of physicians and clinical institutions. This needs further analysis, e.g., done by interviews with such operators. Nevertheless there is a need of such e-services based on the members' views that use VCHC.

8   DISCUSSION

Our first result is that the view of the operators differs quite a lot from the perspective of the members concerning the need for e-services. Our second result is a model of how content, interaction and contribution influence the bonding of community members. The third result is a set of types of e-services that positively influences a community. These results eventually benefit the business model of virtual communities. Actually, the most important aspects as reflected by the members of VCHC are hardly found in any VCHC. These are medical content and member contributions in terms of quality assurance. Together with means of interaction they can create new opportunities for VCHC.

Our empirical study shows, that the independence of the operators is an important factor in influencing the bonding of the members to a VCHC. This allows a neutral perspective on the content the members of VCHC are able to generate and medical content. This is a core property VCHC have and that other players in the e-health sector lack. So we are optimistic that VCHC have indeed possibilities to develop their business models on the basis of new e-services. Yet these e-services have to be designed and implemented.

Acknowledgements

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