

Knowledge Sharing in Virtual Communities of Healthcare Practice

A literature review



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Preface

Thank you for reading this Bachelor Thesis about knowledge sharing in Virtual Communities of healthcare practice. This thesis is written for the BSc Health and Society of Wageningen University and Research Centre.

It was an interesting journey to the chosen topic of this thesis. Together with my supervisor, we encountered a large number of interesting topics to end up with knowledge sharing within a Virtual Community of practice. I found this topic particularly interesting because it would be valuable to society if knowledge of user innovations will be shared fluidly.

During the writing part of this literature review, I learned a lot. First of all, I learned about the phenomenon of knowledge sharing and user innovation, topics that I was not yet familiar with through the courses I followed during my bachelor. Besides the content, I learned a lot about conducting a literature review. Lastly, I enjoyed the part when I was comparing the results of this review with previous literature and got an insight into how findings were connected.

I'm very grateful for all the support I got during the time I wrote my thesis. However, there are a few people I want to thank specifically. In particular, Jasmina Rueger who has been my supervisor during the process of writing my thesis. I want to thank her for her support, enthusiasms and thinking along, during challenging parts of my thesis. It was a pleasure to work together. I also wanted to thank my friends for their ongoing support and motivational talks during our coffee breaks outside the library.

I hope you enjoy reading this thesis!

Esther de Bijl

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Abstract

Introduction Health professionals gain experience and knowledge in their daily practice of work. Occasionally they encounter a valuable innovation for example on a certain treatment. They can use this user innovation in their daily practice however if they don't share this valuable knowledge with other colleagues, it will be a loss for society. Unfortunately, the diffusion of knowledge is time and cost consuming. However, a Virtual Community of Practice (VCoP) might be an efficient channel to diffuse their innovation since it is accessible despite time or geographical location. This literature review aims to get insight into the barriers and stimulators for individual health professionals to contribute their knowledge in a VCoP. Moreover, it will discuss if it could be a proper channel to diffuse user innovations given the founded barriers and stimulators.

Method A literature review was conducted to answer the research question. Scopus was searched and a total of 17 articles were included.

Results Several barriers and stimulators were identified in the included articles. The findings are structured with the use of the model on Motivations and Social Capital of Wasko and Faraj (2005). The barriers and stimulators for the Individual Motivations were found to be: Status, Unlimited access to up-to-date knowledge, Perceived usefulness and Community-related outcome expectations. The second construct is Cognitive Capital, this is about the resources one needs to possess to contribute knowledge. The results concerning Cognitive Capital pointed to the following barriers and stimulators: Lack of (technical) knowledge & skills and a Lack of Time.

The third construct of Structural Capital is mainly about Social Interaction Ties and the extent to which a health professional is embedded in a network. Relational Capital refers to the willingness to help, trust and about identification with the collective, in this case, the VCoP. The included articles noted the following barriers and stimulators on the Relational Capital: Sense of Community, Identification, Reciprocity, Community, and Willingness to Contribute. Finally, some other barriers and stimulators were identified which did not fit with the presented constructs and are thus discussed separately, these are about the role of a facilitator, asynchronous methods of communication and a focused VCoP.

Conclusion The results of this literature review shows that there are some important barriers to overcome, for a VCoP to be a successful channel for the diffusion of user innovations. However there are also some stimulators to enhance knowledge contribution. This review suggests that when these barriers and stimulators are considered when facilitating a VCoP, it can be a suitable way of sharing user innovations between health professionals.

1. Introduction

Within healthcare one can find, just like in many other sectors user innovators, people who modify or develop a treatment, a technical aid product, or medical device to cope with a health condition (Habicht, Oliveira & Shcherbatiuk, 2012). User innovators can be defined as: 'The ones who have developed a new good or service or modified an existing good or service for own use; they differ from producer innovators for whom profit is the dominant motivation to innovate (Von Hippel, 1998).' User innovation is also referred to as the democratizing of innovation because users do not solely have to rely on manufacturers for as they become able to innovate for themselves (Von Hippel, 2005). Users are, according to van Hippel (2005), firms or individual consumers that expect to benefit from using a product. The relationship between innovator and innovation can be connected to a specific function, attribute, or features of products and services (Von Hippel, 2005). As long as the user innovator has direct benefit from it and do not have to sell the innovation to benefit. In the case of the physician-patient relationship, both can be a user innovator because the physician can benefit from the effective use of a certain drug or treatment as well as a patient who will experience a health benefit. The health professional is not the end-user that benefits from the innovation, that would be the patient. This is why sometimes a health professional who is a user innovator is referred to as a clinician innovator. However, since this literature review only concerns the health professional and not the patient, the term 'user innovation' will be used for innovations developed by health professionals.

The valuable information that a health professional gained with his innovation can be 'sticky.' This means that the information is costly to acquire, transfer and use (Von Hippel, 1994). A clinician who possesses the knowledge of a valuable health innovation often has little incentive to share to his peers due to various reasons, for example, because the evidence of efficacy needs to be more than would be needed for recommendations in their daily practice and the costs for this effort is higher (Von Hippel, DeMonaco & De Jong, 2017). Health professionals are mostly motivated to help their own patients with a certain innovation or gained knowledge, they can achieve that goal without making the effort to diffuse the innovation (Von Hippel et al., 2017). On top of that, it requires uncompensated time for a health practitioner to diffuse an innovation (Von Hippel et al., 2017). This indicates a low incentive for health practitioners to share their valuable knowledge. However, to enhance the healthcare practice in society, this research explores a channel to facilitate the diffusion of user innovations.

This possible channel that will be explored in this literature review which might facilitate user innovation diffusion, is a Virtual Community of Practice (VCoP). A VCoP is chosen because it has the potential to be a solution for the amount of effort it cost for the health professional to share their valuable knowledge. A VCoP can be accessed anywhere at any time, this may enable diffusion regardless of problems about time or geographical location that a health professional may encounter.

A community of practice consists according to Wenger, McDermott & Snyder (2002) of groups of people who share a concern, set of problems or a passion about a topic, and who deepen their knowledge and expertise in this area by ongoing interaction. Within this interaction, they share knowledge, insight, and advice (Wenger et al., 2002). The concept of a CoP was a central element in the theory of 'Situated learning' from Wenger & Lave (1991). In the book 'Cultivating Communities of Practice (2002), Wenger et al. (2002) stress the importance of knowledge management in the present business, some specific knowledge may be the key to success for one's organization. The authors recognizing another benefit of the CoPs. They state that people nowadays are also competing with talent, people with expertise and the ability to implement innovative ideas. Although Wenger and Lave (2002) introduced the theory of a Community of Practice as an important concept for business there is an increase in empirical research papers on CoPs being published in the healthcare literature since 2005 and web-based communication systems are being utilized to facilitate communication more often (Ranmuthugala, Plumb, Cunningham, Georgiou, Westbrook & Braithwaite, 2011).

This leads to the concept of Virtual Communities of practice. The most important characteristic of these VCoPs is their use of the internet instead of face-to-face communities. These VCoPs are not limited by geographical location or institutional boundaries, knowledge sharing can be quick and with a larger

number of individuals (Wasko & Faraj, 2005). An example that illustrates the use of these VCoPs is HOBE+. HOBE+ is an innovative online VCoP of primary care professionals to generate, identify and promote innovation and improvement within the Basque Health System (Mendizabal, Solinís & González, 2013). Not only new ideas occurred in HOBE+, but also pre-existing knowledge and best practices between peers were shared (Mendizabal, Solinís & González, 2013). Furthermore, this VCoP has led to the implementation of 23 ideas of which some reflected changes that were called for by primary care professionals in the past and via HOBE+ finally being implemented (Mendizabal, Solinís & González, 2013). Overall the study of Mendizabal, Solinís and González (2013) evaluated the VCoP as successful and a promising initiative for the future. Many more organizations have also recognized the value a VCoP has for knowledge management and started to support the development and growth of VCoPs to meet their business goals (Gongla & Rizzuto, 2001). With improving technology the quantity and quality of VCoPs are still growing. However many VCoPs have failed due to members' low willingness to share knowledge with other members (James Lin, Wung & Chen, 2009)

The aim of this research, therefore, is to understand the barriers and stimulators on the individual level for healthcare professionals to contribute to Virtual Communities of Practice to have insight to the extent a VCoP will be a useful and suitable mean for the diffusion of user innovations. This will be done by answering the following research question through a literature review:

What are stimulating- and hindering factors on the individual level to share knowledge as a health practitioner within Virtual Communities of Practices in the healthcare setting

2. Theoretical Framework

In this section, the used theory in this literature review will be explained. First, the theory of Social capital and the Social Exchange Theory will be respectively explained since the used framework of Wasko and Faraj (2005) is based on these theories. Furthermore, the framework itself including all its constructs will be explained and finally, the application of the framework in this literature review will be clarified.

2.1 Theory of Social capital

The Social Capital Theory was developed by Pierre Bourdieu in 1986. He conceptualized social capital as "The aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition" (Bourdieu, 1986, p. 248)(Carpiano, 2006). Later on, more scientists wrote about social capital, for example, Robert Putman, who is perceived to be the most influential social capital theorist within public health and community development (Macinko & Starfield, 2001)(Carpiano, 2006). Putnam defined social capital as referring to "features of social organization, such as network, norms, social trust, that facilitate coordination and cooperation for mutual benefit" (Putnam, 1995). In 1998 Nahapiet and Ghoshal developed a model of social capital and defined Social Capital as "The sum of the actual and potential resources embedded within, available through, and derived from the network of relationships possessed by an individual" (Nahapiet & Ghoshal, 1998).

2.2 Social Exchange Theory

Another important theory that partly led to the proposed model of Wasko & Faraj(2005) is the Social Exchange Theory. According to this theory, individuals exchange in social interaction with the expectation that it will lead in some way to social rewards as, approval, status, and respect (Blau, 1964)(Wasko & Faraj, 2005). The model initially assumes rational choice-behaviour where individuals choose based on the perceived cost and benefits whether or not start a relationship (Zafirovski, 2005). However, these exchanges are not limited to material goods but include symbolic values like approval and prestige (Cropanzano & Mitchell, 2005).

2.3 Framework of Social Capital and Knowledge contribution

The framework of Wasko & Faraj (2005) uses both the theory of social capital and The Social Exchange Theory to examine with the help of the framework how individual motivations and social capital foster knowledge contribution (Wasko & Faraj, 2005). The research of Wasko & Faraj to build their framework is initiated with the question: 'Why do people spend their valuable time and effort contributing knowledge and helping strangers in electronic networks of practice? This perspective is consistent with the aim of this literature review. The framework entails four concepts which are the dependent variables. Firstly, Individual Motivations, second, structural Capital, thirdly, Cognitive Capital and Relational Capital, these concepts may lead to the independent variable of Knowledge contribution.

Individual Motivation

The first concept of the framework of Wasko & Faraj (2005) is Individual Motivation. In the end knowledge contribution only occurs when an individual chooses that they are able and willing to contribute their knowledge (Wasko & Faraj, 2005). Therefore, the expectation of personal benefits can motivate individuals to contribute knowledge to others even when there is no personal acquaintance, similarity, or the likelihood of direct reciprocity (Constant, Sproull & Kiesler, 1996). These personal benefits can, for example, be developing expertise, boosting self-esteem or enjoy of helping others (Ardichivili, 2008) (Razmerita, Kirchner & Nielsen, 2016) (Kankanhalli, 2005). In the Social Exchange Theory 'status' is one of the proposed social rewards that individuals expect when engaging in social interaction (Blau, 1964). This is reflected in the literature on electronic networks that suggests that building reputation is a strong motivator (Donath, 1998)(Ardichivili, 2008).

Structural capital

The second concept is Structural Capital. This can be defined as the density of connections in a collective (Wasko & Faraj, 2005). From the Theory of Social capital, it is suggested that networks and connections between individuals are predictors for collective action (Putnam, 1995). This implies that the extent to which an individual is connected in a network is important for their contribution. One could measure the place of an individual in a network by the number of social ties (Ahuja, Galleta & Carly, 2003). A social tie occurs when individuals are posting messages and responding to messages (Wasko & Faraj, 2005). Ahuja et al. (2003) found that central individuals in a network were higher performers. A suggested explanation for this by Ahuja et al. (2003) was that members who are central or highly embedded are more likely to receive information of higher quantity and quality than less central individuals because they are more likely to be linked with other powerful actors in the network. A study in a non-health context on embeddedness of Grewal, Lilien & Mallapragada (2006) also reflects this theory by suggesting that the network embeddedness was positively related to the success of an open-source project. This embeddedness can foster new knowledge because high connected members have access to information and knowledge resources in the network that allows them to transform the knowledge on other sources of user-generated content by combining it with their own experience (Carlile & Reber, 2003).

Cognitive capital

This third concept of the framework, cognitive capital, is defined by Wasko & Faraj (2005) as the resources that make possible shared interpretations and meaning within a collective (Wasko & Faraj, 2005). It consists of both individual expertise or mastery of the language within practice, as well as experience with applying the expertise (Wasko & Faraj, 2005). It is for an individual not enough to be motivated, one should have the required cognitive capital or in other words, the required knowledge to contribute (Wasko & Faraj, 2005). An important factor for Cognitive Capital is the extent of self-efficacy of an individual. With self-efficacy is meant the individuals' evaluation of one's capabilities concerning some intended behaviour (Bandura, 1991) Knowledge sharing self-efficacy refers more specifically to the belief an individual has in being able to effectively share information (Van Acker, Vermeulen, Kreijns, Lutgerink & van Buuren, 2014). Wasko and Faraj (2005) refer to this with a similar term of Self-rated Expertise. Individuals with higher levels of expertise are found to be more likely to provide useful advice on computer networks (Constant et al., 1996) and people with longer tenure in the shared practice are better able to share knowledge (Wasko & Faraj, 2005).

Relational capital

This third concept can be referred to as the affective nature of the relationships within a collective (Nahapiet & Ghosal, 1998). Relational capital is about identification with the collective, trust and the perceived obligation to participate and willing to help other members (Lewicki & Bunker, 1996)(Putnam, 1995)(Coleman, 1990. Trust plays a role in a Virtual Community since within such a community member need to depend upon other community members given that the behaviour of other community members cannot be enforced (Ridings, Gefen & Arinze, 2002). Ridings et al. (2002) found that this concept of trust was a significant predictor for the desire for a member of a virtual community to exchange information. Wasko & Faraj (2005) examine in their framework two dimensions of this: commitment and reciprocity. Wasko and Faraj (2000) found that people participate in networks due to a perceived moral obligation to pay back the network and the whole profession. Moreover, the study of Mascia, Palotti & Dandi (2018) and reflects the statement of Wasko & Faraj (2005) by finding that reciprocity is a determinant for knowledge-sharing in a network followed by Cheung, Lee and Lee (2013) who suggests that reciprocity impacts satisfaction of members and intention to continue knowledge contribution.

Knowledge Contribution

The formerly described constructs are related to Knowledge Contribution. The framework of Wasko and Faraj (2005) describes two aspects of knowledge contribution. First, the volume of knowledge contribution by posting response messages and the average helpfulness of those responses. The contribution of knowledge is not for granted since there is in the literature on VCoPs often a group

identified as 'lurkers' (Sun, Rau & Ma, 2014). These are people who are a member of a community even though they do not add to the community but only learn from the knowledge being shared by others and not contributing by themselves. People who actually do contribute knowledge are often called 'posters' (Sun et al., 2014). Since knowledge is valuable, these people may perceive it as a loss of resource when contributing (Gray, 2001)

2.4 Application of theory

The model of Wasko & Faraj (2005) will be used to structure the results of this literature review, this means the finding will be categorized within the different concepts of the model. Not fitting findings are mentioned separately. In the discussion section of this review, a reflection is given on the fitting of the model with the findings of this literature review.

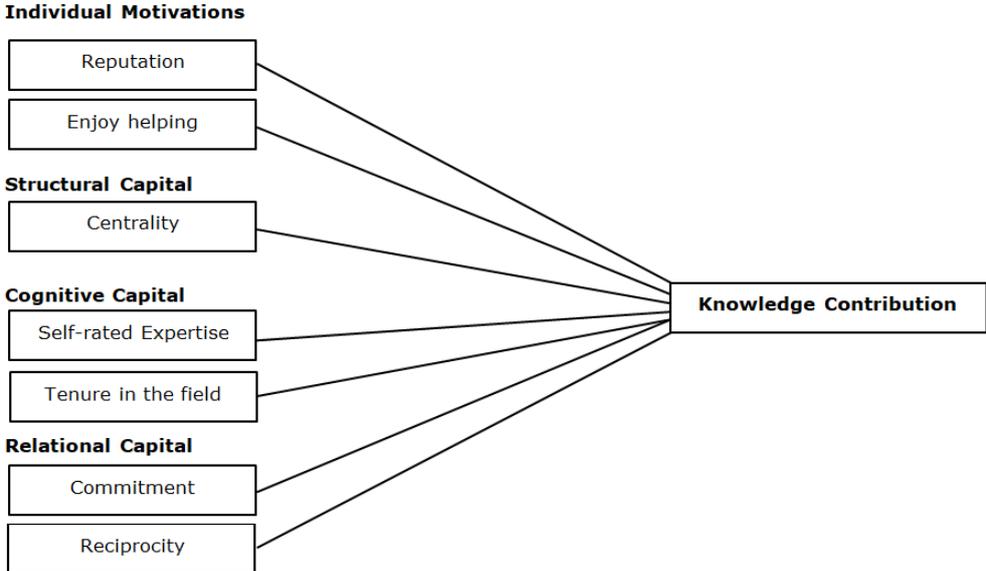


Figure 1: Individual Motivations, Social Capital, and Knowledge Contribution(Wasko & Faraj, 2005)

3. Methods

3.1 Search string

To answer the research question, a literature review is conducted. The database that is being used is Scopus. Multiple search queries are made to explore the most valuable search string. The first search query gave 190 results (Table 1). However, after a quick scan, a lot of the results included articles on online communities for a user, patients, and consumers instead of health practitioners. Therefore in search query 2 'online communities' were excluded. Scanning the results of the second query gave additional synonyms of the concept of 'Virtual Community of Practice'. These synonyms were included in search query 3. To explore the effect of the inclusion of the concept of 'health', 'health' was excluded in search query 4. However, this resulted in 1741 results, which is an unfeasible amount of articles within the scope of this literature review. Finally, the literature review will be conducted with the use of search query 3.

Search query	What are stimulating and hindering factors on the individual level to share knowledge as a health practitioner within Virtual Communities of Practices in the healthcare setting?	Results
1	("knowledge sharing" OR contribut* OR "dissemination of information" OR "information sharing") AND (VCoP* OR "virtual communit* of practice*" OR "online communit*") AND health	190
2	("knowledge sharing" OR contribut* OR "dissemination of information" OR "information sharing") AND (VCoP OR "virtual community of practice" OR "online community of practice") AND health	26
3	("knowledge sharing" OR contribut* OR "dissemination of information" OR "information sharing") AND (VCoP OR "virtual community of practice" OR "online community of practice" OR "community of practice" OR CoP OR "collaborative online community of practice" OR "online professional network") AND health	147
4	("knowledge sharing" OR contribution OR "dissemination of information" OR "information sharing") AND (VCoP OR "virtual community of practice" OR "online community of practice" OR "community of practice" OR CoP OR "collaborative online community of practice" OR "online professional network")	1741

Table 1: Search string using Scopus

3.2 Inclusion and exclusion criteria

To select all the relevant articles for conducting a review the following inclusion- and exclusion criteria are made:

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> - Articles in English - Articles on VCoPs - Peer-reviewed articles - Articles on online knowledge sharing - Studies in all countries 	<ul style="list-style-type: none"> - Articles about non-professionals sharing in communities - Articles before 2002 - Articles on physical communities - VCoP based on Social media - Articles on the technical infrastructure of VCoPs

Table 2: Table of inclusion and exclusion criteria

The inclusion criterion about all countries is added because some studies on VCoP are in rural countries where health facilities are very remote. These VCoPs experience some different additional barriers and stimulators in comparison with VCoPs in western countries. For example internet access, language barriers or time difference. However, these studies will still be included since this study focuses on the individual aspects of knowledge contribution to VCoP instead of technical aspects.

A lot of studies are on CoPs which include face-to-face meetings and are not online, these articles are excluded. However, articles on CoPs that include both are selected to study the stimulators and barriers for the online part of the community. This exclusion criterion is the cause of the large amount of excluded articles in the selection process, as is seen in figure 3 between n=63 towards n=11 articles. A

lot of abstracts included the term 'Community of practice' however when reading the full articles, almost all of them were on face-to-face communities.

Articles on VCoPs based on social media, for example, Twitter hashtags or Facebook posts are excluded since these VCoPs are not considered suitable mediums regarding the context of this literature review. Because when a suitable medium is being investigated for sharing knowledge about off-label drug user-innovations, social media communities are perceived to not fit for the kind of knowledge that needs to disseminate due to patient safety or privacy when cases are being used by health professionals to illustrate the innovation.

Since this literature review aims to give insight into stimulators and barriers on the individual level, articles solely on the (technical) design of the VCoPs are excluded. However, articles that find for example 'ease of use' or 'lack of technological' as a barrier, does not fall under this exclusion criterion, because these are barriers for the individual.

Furthermore, another six articles are found to be useful for reviewing through snowballing. Within the reference lists of the previous found eleven articles, there is searched after the term 'Virtual Community of Practice' in combination with terms as 'barriers', 'stimulators', 'motivations', 'drivers' et cetera.

Figure 2 shows the number of published documents overtime in Scopus. Since the amount of literature before 2003 is negligible, only articles after 2003 will be included. Based on these criteria 17 articles are selected for reviewing. The process of selecting relevant studies is shown in figure 3 and an overview of included articles and their outcomes can be found in the Appendix.

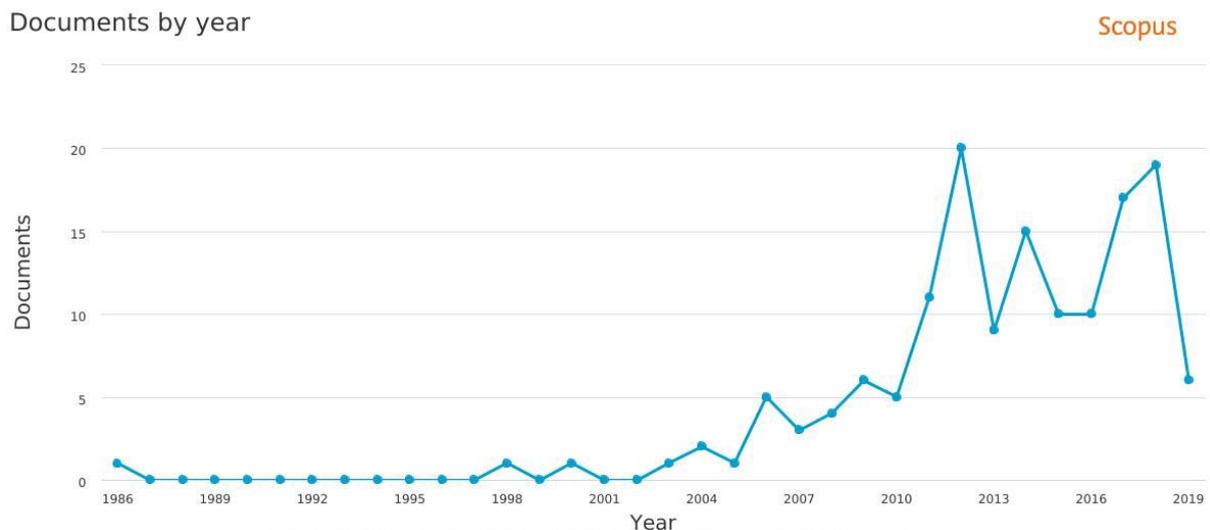


Figure 2: Amount of articles published in Scopus over time

3.3 selection process

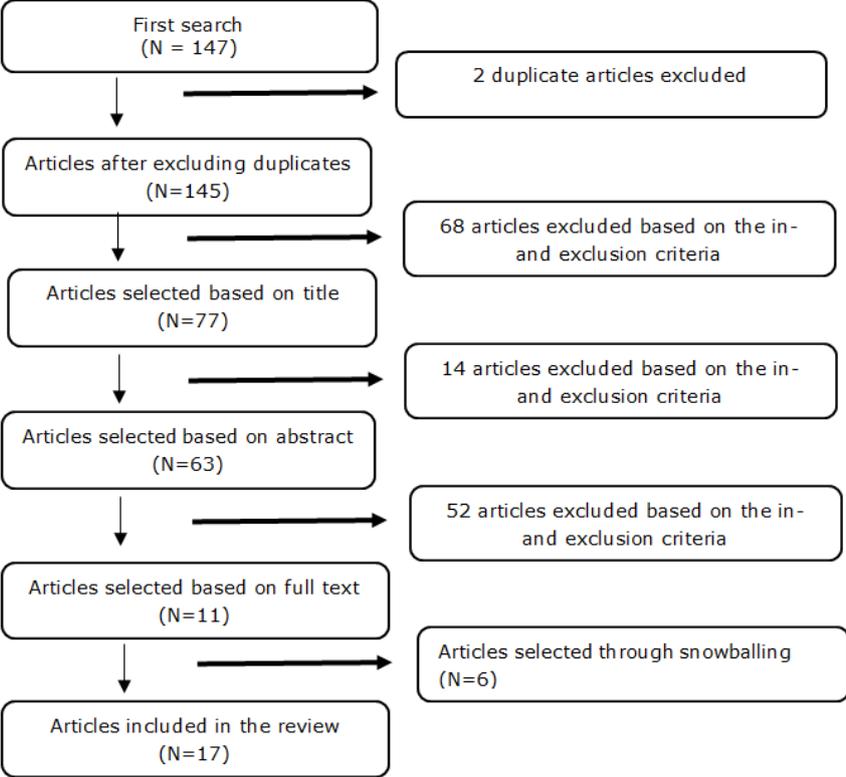


Figure 3: Flowchart selection of articles

3.4 Quality assessment

To assess the quality of the selected studies, the TAPUPAS framework will be used. The TAPUPAS framework is developed by Pawson, Boaz, Grayson, Long & Barnes (2003) to assess the quality of social care knowledge. This framework is useful for this literature review because it contains criteria that can be applied to both qualitative and quantitative studies. The 10 criteria based on the TAPUPAS framework are shown in Table 3. The studies will get 10 points assigned when all criteria are met, which means 1 for each criterion. Studies with less than 5 points were considered of low quality, 5 to 7 points medium and 7 or more are considered of high quality. The scoring is shown in Table 4 and the final score is also included in Table 10 in the Appendix.

Testing for:	10 Criteria based on TAPUPAS
T ransparency	1. A clear description of study aim
A ccuracy	2. Appropriate size of sample
P urpositivity	3. Sound selection/sampling of sample
U tility	4. Appropriate description of the context of the study and the study participants
P ropriety	5. Conclusions supported by the data
A ccessibility	6. Sound description of limitations
S pecificity	7. Sound data
	8. Appropriate analysis to answer the research question
	9. Logical, traceable, and clear documentation of the research process
	10. Sound extrapolation of conclusions to the theoretical population

Table 3: TAPUPAS framework and criteria

Reflection on quality assessment

Overall the quality of the included articles was rated as remarkably high. Only two out of seventeen articles are rated as medium quality. Furthermore, the criterion that was least met, was number six about the description of limitations, which was even absent in some articles. All the articles were from peer-reviewed and relatively high-quality journals.

Article/criteria	Criteria met:	Total score	Quality
Ardichvili, Page & Wentling (2003)	1, 2, 3, 4, 5, 7, 8 & 10	8/10	High
Barnett, Jones, Bennett, Iverson & Bonney (2012)	1, 2, 3, 4, 6, 7, 8 & 9	8/10	High
Bertone et al., 2013	1, 2, 3, 4, 7 & 8	6/10	Medium
Chiu, Hsu & Wang (2006)	2, 3, 4, 5, 6, 7, 8, 9 & 10	9/10	High
Curran, Murphy, Raza Abidi, Sinclair & McGrath (2009)	1, 2, 3, 4, 7, 8 & 10	7/10	High
Evans, Yeung, Markoulakis & Guilcher (2014)	1, 2, 3, 4, 6, 7, 8, 9 & 10	9/10	High
Falkman, Gustafsson, Jontell & Torgersson (2008)	1, 2, 4, 5, 7, 8, 9 & 10	8/10	High
Friberger & Falkman (2013)	1, 2, 3, 4, 5, 6, 7, 8, 9 & 10	10/10	High
Hara & Hew (2007)	1, 2, 4, 5, 6, 7, 8, 9 & 10	9/10	High
Hurtubise, Rivard, Héguay, Berbari & Camden (2016)	1, 2, 3, 4, 5, 6, 7, 8 & 9	9/10	High
Ikioda, Kendall, Brooks, De Liddo & Buckingham Shum (2013)	1, 2, 3, 4, 5, 7, 8, 9 & 10	9/10	High
Lacasta Tintorer et al. (2015)	1, 2, 3, 4, 5, 6, 7, 8, 9 & 10	10/10	High
Lacasta Tintorer et al. (2018)	1, 2, 3, 4, 7, 8, 9 & 10	8/10	High
Majewski & Usoro (2011)	4, 5, 7, 8 & 10	5/10	Medium
Mazer et al. (2015)	1, 2, 4, 5, 6, 7, 8, 9 & 10	9/10	High
McLoughlin, Patel, O'Callaghan & Reeves (2018)	1, 2, 3, 4, 5, 6, 7, 8, 9 & 10	10/10	High
Stewart & Abidi (2012)	1, 2, 3, 4, 5, 6, 7, 8 & 10	9/10	High

Table 4: Critical quality assessment using TAPUPAS framework

4. Findings

Analysis of results

This section provides an analysis of the outcomes of the selected articles. It presents the founded barriers and stimulators for contributing knowledge. The analysis follows the structure of the presented framework of Wasko & Faraj (2005). The constructs will be analysed regarding respectively: Individual motivation, Structural Capital, Cognitive Capital, Relational Capital. Finally, other identified types of barriers and stimulators will be analysed. After each construct, an overview will be given on the barriers and stimulators including the articles that identifies them. An overview of outcomes per included article can be found in the Appendix.

4.1 Individual Motivation

Perceived usefulness

Individuals are motivated, according to the included literature, when the contribution of knowledge in a VCoP is perceived to be useful for the daily work as a health professional (Ikioda, Kendall, Brooks, De Liddo & Buckingham Shum, 2013) The perception of usefulness for improving clinical practice is also identified by Lacasta Tintorer et al. (2015) together with the perceived usefulness for reducing costs (Lacasta Tintorer et al., 2015)(Majewski & Usoro, 2011). The costs that can be saved are for example the costs of the high amount of referrals from Primary Care to a specialist, if specialists and Primary Care physicians can discuss online, fewer referrals may be needed (Lacasta Tintorer et al., 2015). The study of Chiu, Hsu & Wang (2006) note that community-related outcome expectations can also engender knowledge contribution.

Access to up- to- date knowledge

Other benefits that stimulate knowledge contribution can be summarized as unlimited access to up- to- date knowledge, the possibility of an ongoing discussion and the benefit of a central place to keep track of information (Majewski & Usoro, 2011)(Mazer et al., 2015). The motivation of contributing knowledge to a VCoP to create a place where a health professional can access up- to- date information is also reflected in the article of Lacasta Tintorer (2018). Hara and Hew (2007) also identifies this benefit but add to it by arguing that it creates a better understanding of the current knowledge and validation of one's practice because in a VCoP it is possible to give feedback and comment on contributed knowledge. This will refine the knowledge and the understanding of the contributed knowledge (Hara & Hew, 2007).

Status

A barrier within the construct of individual motivation that hinders knowledge contribution is the fear of losing face or being laughed at by more experienced members by posting or asking questions (Majewski & Usoro, 2011)(Lacasta Tintorer, 2018) The opposing concept of the fear of losing face is the opportunity to gain status by contributing knowledge to a VCoP which functions as a stimulator and reason to contribute (Ardichvili, Page & Wentling, 2003).

Individual motivations		Articles
Community-related Outcome expectations		Chiu et al. (2006)
Perceived usefulness	For improving daily practice	Lacasta Tintorer et al. (2015) Ikioda et al. (2013)
	For reducing costs	Lacasta Tintorer et al. (2015) Majewski & Usoro (2011)
Unlimited access to up- to- date knowledge	Possibility for ongoing discussion	Mazer et al. (2015)
	Benefit of a central place to keep track of current information	Majewski & Usoro (2011) Mazer et al. (2015) Lacasta Tintorer (2018)
	Better understanding of current knowledge	Hara & Hew (2007)
Status	Fear of losing face	Majewski & Usoro (2011) Lacasta Tintorer (2018)
	Possibility to gain status	Ardichvili, Page & Wentling (2003)

Table 5: Overview Individual Motivation

4.2 Structural Capital

Social Interaction ties

Only two of the included studies specifically address the construct of Structural Capital. The study of Chiu et al. (2006) found that social interaction ties are significant for the quantity of knowledge sharing. To enhance these social interaction ties one could, for example, organize meetings and seminars (Chiu et al., 2006). Social interaction ties, sometimes referred to as embeddedness, can also enhance knowledge contribution when it is about working with people who already participated in a community before with the same people. This repeated interaction can facilitate trusting relationships which are suggested to increase knowledge contribution (Chiu et al., 2006). Nahapiet and Ghosal (2013), cited in Chiu et al. (2006), are arguing that network ties influence both access to parties for combining and exchanging knowledge and anticipation of value through such exchange. The latter is also reflected in Stewart and Abidi (2012) who argue that when knowledge sharing is perceived to be valuable it stimulates the willingness to contribute. The perceived value of knowledge sharing is part of the concept of relational capital and will also be explained later on.

The benefit of prior social interaction is also noted by Granovetter (1985) in Ardichvili et al. (2003) by arguing that economic activity in an organization is embedded in prior social networks and the organizational behaviour is determined by this embeddedness. Ardichvili et al. (2003) argues then that this embeddedness means that people are more likely to share knowledge if this is asked by members of their earlier networks. This reoccurring social interaction is based on trust. This kind of trust occurs when actors get to know one another and are able to predict what is to expect and how the other half will behave in a certain situation according to Tschannen-Moran and Hoy (2001) cited in Ardichvili et al. (2003). The important concept of trust is important for knowledge contribution and will also be highlighted later on in the concept of relational capital.

Structural Capital	Articles
Repeated interaction	Chiu et al. (2006)
Social interaction ties	Ardichvili et al. (2003)

Table 6: Overview Structural capital

4.3 Cognitive Capital

Lack of (technical) knowledge and skills

To be able to contribute knowledge to a VCoP a health professional needs to have the resources or the Cognitive Capital to make contribution possible. The literature gives many barriers for contribution in this area. First, a health professional can experience a lack of technical knowledge and skills (Curran, Murphy, Raza Abidi, Sinclair & McGrath, 2009)(Mazer et al., 2015). This barrier mainly consists because of difficulty with the design of the VCoP or because health professionals have difficulty with accessing the platform. The latter is also recognized by Barnett, Jones, Bennett, Iverson & Bonney (2012) and Lacasta Tintorer (2018). The barrier of using a password exists according to the literature of Barnett et al. (2012) mostly because a member can lose or forget it. Moreover, when contributors to VCoP have to use too many clicks and intermediate steps before entering the VCoP it also can be a barrier to contribute (Lacasta Tintorer, 2018). David, Poissant and Rochette (2012) cited in McLoughlin, Patel, O'Callahan & Reeves (2018), found in their study that health professionals had a low competency for using the VCoP. This relates to the concept of perceived ease of use of a VCoP which is noted to be an important enabler in a virtual community (Barnett et al., 2012)(Mazer et al., 2015)(McLoughlin et al., 2018). Another barrier related to ease of use is inadequate technology (Majewski & Usoro, 2011). An enabler is self-efficacy according to Majewski and Usoro (2011) who are referring in their literature review to Hsu, Jub, Yenc & Chang (2007) who found that self-efficacy promotes knowledge sharing.

Lack of time

Lack of time is an barrier for knowledge contribution that is reflected in many studies as it is noted in six studies that were included (Curran et al., 2009) (Falkman, Gustafsson, Jontell & Torgersson, 2008)(Lacasta Tintorer et al., 2015) (Majewski & Usoro, 2011) (Mazer et al., 2015). The lack of time was identified as an important barrier because the workload of the health professionals was too heavy to create time for knowledge contribution (Falkman et al., 2008). When the VCoP is not integrated into the workstation it may be a barrier for knowledge contribution(Lacasta Tintorer, 2018). However, even when the VCoP was completely connected with work, lack of time was the main barrier for use of the VCoP(Lacasta Tintorer, 2018). In the study of Mazer et al. (2015) lack of time was also the main reason why participants were dissatisfied with their participation.

Cognitive capital		Articles
Lack of (technical) knowledge & skills		Curran et al. (2009) Mazer et al. (2015)
	Difficulty with accessing	Barnett et al. (2012) Lacasta Tintorer (2018)
	Difficulty with design	Mazer et al. (2015)
	Perceived ease of use	Barnett et al. (2012) Mazer et al. (2015) McLoughlin et al. (2018)
	Inadequate technology	Majewski & Usoro (2011)
	Self- Efficacy	Majewski & Usoro (2011)
Lack of time		Curran et al. (2009) Falkman, Gustafsson, Jontell & Torgersson (2008) Lacaste Tintorer et al. (2015) Lacasta Tintorer et al. (2018) Majewski & Usoro (2011) Mazer et al. (2015)

Table 7: Overview of Cognitive Capital

4.4 Relational Capital

Sense of community

On the relational level Hubertise, Rivard, Hégu, Berbari and Camden (2016) and Majewski and Usoro (2011) identifies that a sense of community can stimulate knowledge contribution. A sense of community is important for engagement (Hubertise et al., 2016)(McLoughlin, Patel, O’Callaghan & Reeves, 2018).

Identification and reciprocity

Another study noted that identification, as a sense of belonging, had a significant effect on the quantity of knowledge sharing (Chiu, Hsu & Wang, 2006). The study of Majewsky and Usoro (2011) views reciprocity as an antecedent for a sense of community that should influence knowledge sharing.

Community

Furthermore, the level of trust is found to be another stimulator for knowledge (Bertone et al., 2013)(McLoughlin et al., 2018). The study of Chiu et al. (2006) however found that trust had a significant effect on the quality of the contributed knowledge, but not on the quantity. The literature review of Majewski and Usoro (2011) suggests that trust is the most prominent factor for knowledge contribution in a VCoP. Majewski and Usoro (2011) refer to Fang and Chiu (2010) by saying that trust is a key enabler in relations between spatially and temporally dispersed people when information asymmetry, uncertainty, and fear of opportunism threaten to inhibit the virtual community. Literature suggests that participants will be less hesitant to contribute knowledge once they trust that the other members will not misuse the posted information (Ardichvili et al., 2003). Several included studies noted that participants in a VCoP share information more easily when the environment of the community is risk-free, positive and encouraging (McLoughlin, 2018)(Barnett et al., 2012). This increases trust and

stimulates knowledge sharing even when members have traditionally different hierarchical positions (McLoughlin, 2018). Such an environment can be, according to the study of Bertone et al. (2013) be fostered by commitment and passion for the subject. When members still experience this barrier and remain in a peripheral position it could reduce the effectiveness of the VCoP (Bertone et al., 2013). The article of Hara and Hew (2007) also suggests that a VCoP that is not competitive stimulates knowledge sharing in comparison with a traditional work environment. A shared vision had a significant relation with the quality of knowledge sharing, but not quantity (Chiu et al., 2006).

Willingness to contribute

One of the included studies identifies that a moral obligation can also be a reason to contribute (Ardichvili et al., 2003). The willingness to contribute knowledge is suggested to be stimulated by self-selection, which results in members who want to share knowledge instead of having to (Hara & Hew, 2007)(Barnett et al., 2012). This willingness to contribute exists, according to the study of Stewart and Abidi (2012) because members see the value of the knowledge to be shared, which is also noted by Majewski and Usoro (2011). In addition to that, three other included studies identify that respectively intrinsic motivation, self-motivation and a desire to share knowledge of participants is an important stimulator for contributing knowledge (Evans, Yeung, Markoulakis & Guilcher, 2014) (McLoughlin, et al., 2018)(Stewart & Abidi, 2012).

Relational Capital		Articles
Sense of community		Majewski & Usoro (2011) Hubertise et al., (2016) McLoughlin et al. (2018)
Identification		Chiu et al. (2006)
Reciprocity		Majewski & Usoro (2011) Chiu et al. (2006)
Community	Trust	Bertone et al. (2013) McLoughlin et al. (2018) Chiu et al. (2006) Majewski and Usoro (2011) Ardichvili, Page & Wentling (2003)
	Commitment	Bertone et al. (2013)
	Risk-free environment	McLoughlin (2018) Barnett et al. (2012)
	Non- competitiveness	Hara & Hew (2007)
	Shared vision	Chiu et al. (2006)
Willingness to contribute	Moral obligation	Ardivelli (2003)
	Self-selection	Hara & Hew (2007)(Barnett et al. (2012)
	Perceived value of knowledge sharing	Stewart & Abidi (2012)

Table 8: Overview of relational Capital

4.5 Other identified barriers and stimulators

The included articles in this literature review resulted not only in stimulators and barriers that were in line with the model but also ones that were not. The factors that were noted more than once will be explained and the remaining factors will be shortly mentioned at the end.

Use of a facilitator

Most of the included literature stressed the importance of the role of a facilitator as a stimulator for knowledge contribution in a VCoP. Eleven articles that are included in this review mentioned the role of some facilitator but are using different names for it, such as champion, knowledge broker a moderator. These roles are mostly similar but can slightly differ. A facilitator can be the one who was the initial leader of the VCoP but is not necessarily the case (Barnett et al., 2012). The most important role of a facilitator is to improve the collaboration (Barnett et al., 2012). Bertone et al. (2013) add the responsibility for the facilitator to protect dissident opinions, organize eye-opening events and practice self-assessment when the evidence base is shallow. In the study of Curran et al. (2009). The facilitator was called a content expert and community members could ask questions specific to the content expert when they, for example, experienced a knowledge gap. In the study of Friberger and Falkman (2013)

however, these roles of expert and facilitator were divided into two different roles that were both stimulating for knowledge contribution. A moderator can also have the task of helping new members accessing the VCoP by offering their help (Hara & Hew, 2007). When there is a lack of moderation networks may be unconnected (Ikioda, et al., 2013). Finally, it is important that a facilitator is capable and willing to engage all potential contributors of the community to contribute knowledge (Stewart & Abidi, 2012).

Similar to the function of a facilitator, can be the use of guiding questions and collaborative assignments to stimulate knowledge contribution (Evans et al., 2014). Furthermore, email reminders are also mentioned in one included article to stimulate knowledge contribution (Barnett et al., 2012)

Asynchronous method of communication

A second identified enabler is the use of asynchronous method of communication. Barnett et al. (2012) identified that a lot of studies used for example communication by email and discussion boards. Asynchronous methods of communication are suggested to be a method to overcome the lack of trust due to few social interactions (McLoughlin et al., 2018). This is because when offering multiple channels of communication, social interaction can be enhanced and thus trust (McLoughlin et al., 2018).

Clear objectives

The stimulator of a VCoP with clear objectives or a focused VCoP is noted multiple times in the included articles of this literature review (Barnett et al., 2012) (Bertone et al. 2013) (McLoughin, et al. 2018)

Other barriers and stimulators for knowledge contribution that are shortly noted in the included articles are for example allowing new members to join (Ikioda et al., 2013). Because contribution tended to stagnate until new members keep joining in according to the study of Ikioda et al. (2013). Finally, the speed of responses was also an identified stimulator in the study of Lacasta Tintorer (2018).

Other barriers and stimulators		Article
Use of a Facilitator		Barnett et al. (2012) Bertone et al. (2013) Curran et al. (2009) Friberger and Falkman (2013) Hara & Hew (2007) Ikioda et al. (2013) Stewart & Abidi (2012)
	Guiding questions and assignments	Evans et al. (2014)
	E-mail reminders	Barnett et al. (2012)
Asynchronous method of communication		Barnett et al. (2012) McLoughlin et al. (2018)
Clear objectives		Barnett et al. (2012) Bertone et al. (2013) McLoughin, et al. (2018)
Other types	New members to join	Ikioda et al. (2013)
	Speed of responding	Lacasta Tintorer (2018)

Table 9: Overview of other barriers and stimulators

5. Discussion

The main aim of this literature review was to give insight into the existing barriers and stimulators for user innovation for the individual health professional and the use for sharing user innovation. In this section, a summary of key findings will be given followed with a discussion on the identification with the theory. The identified barriers and stimulators will be used to discuss the usage of VCoPs for the dissemination of health user-innovations in the implication for practice. Finally, some limitations will be addressed together with some directions for future research.

Summary of key findings

The most frequently noted barriers in the included literature are, the lack of time and the lack of (technical) knowledge and skills. It may be hard to overcome the barrier of time since it appeared from the study of Lacasta Tintorer (2018) that even integration in workstations did not overcome this lack of time. However, the respondents, who were part of a VCoP, in a previous study of Rosen, Furst and Blackburn (2007) proposed some solutions for overcoming the lack of time. For example by labeling topics as important or by using a format to be able to quickly learn relevant knowledge (Rosen, Furst & Blackburn, 2007). Furthermore, despite the time constrain a VCoP can be flexibly used and accessed anywhere and anytime (Bermejo-Caja et al., 2019).

In the introduction of this review, it was proposed that clinicians possibly don't share their knowledge because they find it sufficient to improve their daily practice and don't feel the need to help others outside their practice. However, given the findings of this literature review, it might be that health professionals just don't have the extra time which is needed for sharing information. To give knowledge sharing a priority, awareness among health professionals is needed on the note that it is valuable for them in the long run if they share their new knowledge and experience. Since the perceived value of knowledge sharing stimulates the knowledge contribution (Stewart & Abidi, 2012). In the long term, for example, knowledge sharing could improve healthcare and reduce unnecessary referrals (Lacasta Tintorer et al. 2015).

Another frequently noted barrier in the included articles was the lack of (technical) knowledge and skills (Curran et al., 2009)(Mazer et al., 2015). This barrier exists in different forms, like perceived ease of use or problems with accessing. A solution may be found in the study of Curran et al. (2009) where key trainers were appointed to help with technical issues, however problems of accessing still existed. Problems of accessing are caused by a password barrier. Even though a password creates a barrier a VCoP also needs a password since health professionals also need a VCoP that is safe regarding patient privacy and sensitive information (McLoughlin et al., 2018).

The stimulator for knowledge contribution in a VCoP that stood out in this literature review was trust. In the presented theory, the concept of trust is part of the relational capital however, trust is seen as a foundation for almost all other concepts. For example for the concept of structural capital, the concept that is mainly about social interaction ties. Previous literature suggests that the structural dimension of Social Capital and Value Creation are linked with trust and trustworthiness (Tsai & Ghoshal, 1998). Moreover, the findings of this review suggest ways in which trust could be enhanced. Barnett et al. (2012) suggest that multiple ways of communication can overcome a lack of trust, these asynchronous methods of communication could be email and discussion forums in addition to social networks (Barnett et al. 2012). Furthermore, Barnett et al. (2012) also suggest that a focused VCoP can build trust since people have a shared vision in a focused VCoP. Although the studies of Ardichvili et al. (2003) and Chiu et al. (2006) found that shared vision only had a positive effect on the quality of knowledge contribution and not quality.

A facilitator seems to have a very important role according to the findings of this review and may have many tasks. First, of all a facilitator can help with technical problems. The facilitator can also stimulate a respectful and open environment which is again important for building trust (Bertone et al. 2013). The facilitator can also help to keep the focus of the VCoP that is relevant for the daily practice for its

members (Barnett et al., 2012). That way the VCoP stays relevant for the members since they often experience a lack of time.

Identification with the theory

Looking at the results of this literature they almost correspond to all the main points of the framework of Individual Motivations, Social Capital, and Knowledge Contribution (Wasko & Faraj, 2005). The four constructs of individual motivations, structural capital, cognitive capital, and relational capital are represented in the results even though some times with different terms or more in detail. Some outstanding points will be discussed.

Within the construct of the individual motivations, it was remarkable that the concept of helping others was not identified as an individual motivation for knowledge sharing. While existing literature on Virtual Communities suggests it functions as an important motivation to contribute knowledge (Liao, To & Hsu, 2013) (Kankanhalli, Tan & Wei, 2005)(Ye, Chen & Jin, 2006). However an explanation might be found in the study of Liao, To & Hsu (2013) who suggests that members of professional virtual communities are more motivated by extrinsic rewards than intrinsic like helping others is. In spite of this, extrinsic rewards were not found to be a direct stimulator in this review. Instead, this review suggests that health professionals might use a VCoP just to achieve the best results for their job. This fits with the founded perceived benefits of a VCoP, which were noted in the included literature, for example, perceived usefulness or the benefit of a central place to keep up-to-date information. Moreover, it was striking to find the notion of reputation or status, as a stimulator for knowledge contribution by Wasko & Faraj (2005) only in one of the included studies being reflected. A possible explanation for this might depend on the identity of the participants in a certain VCoP. Because one could argue that for example socially isolated health professionals are less motivated by the factor of possibility to gain status since they will less likely gain status in their daily practice if their organizational context doesn't include a network of colleagues. However, a health professional who practice their profession in an academic context, the possibility to gain status might be more relevant.

On the cognitive capital, it was notable that the results of this review where focused mainly on capital in terms of technical issues and a lack of time. While the proposed model also included the factor of perceived knowledge and expertise to contribute knowledge. Previous literature shows, also in line with the model, that the perceived experts in a group share significantly more knowledge than non-experts (Thomas-Hunt, Ogden and Neale, 2003). It might be that the notion of perceived knowledge differs between different sorts of VCoPs. For instance, a homogenous VCoP with participants of the same profession the chance is higher that perceived knowledge is not a barrier for knowledge sharing. At the same time, it is more likely a barrier in a multi-disciplinary VCoP where health professionals do not feel to be able to contribute to a post about a different discipline of knowledge. Therefore this might be interesting in future research on different types of VCoPs as is suggested later on in this research.

However, there are also some differences. For example, the already mentioned underrepresentation of the structural capital. It is hard to find an explanation for this in previous research. Nonetheless, the study of Thomas-Hunt, Ogden and Neale (2003) seems to oppose the argument of Wasko and Faraj (2005) of social interaction ties as being a stimulator for knowledge sharing. Thomas-Hunt, Ogden and Neale (2003) suggest that socially isolated members were the ones that participated more in discussions. Since these professionals are not already connected with colleagues in their practice to share knowledge and ideas and so they have to depend more on other professional networks, such as a VCoP.

On the relational dimension of social capital, the identified aspects of reciprocity and commitment by Wasko & Faraj (2005) was reflected in the literature of this review. Some additional aspects were identified, such as the sense of community and the willingness to contribute and the importance of trust. The theory of Wasko and Faraj (2005) already identifies trust as a key aspect of relational capital however, it seems also to be an aspect of the construct of structural capital. Trust is namely the driver of repeated social interaction and is suggested to increase with the use of asynchronous methods of communication. Besides the asynchronous method of communication, additional literature suggests that

perceived responsiveness builds trust (Ridings et al., 2002). When members in a Virtual Community reply quickly and often, members will have higher levels of trust (Ridings et al., 2002). Ridings et al. (2002) suggest also that knowing personal information of members enhances trust. This study also found that a disposition to trust, a general willingness, stimulates trust in a Virtual community. To explain the opposing finding on shared vision not having a positive effect on the quality of knowledge contribution in Ardichvili et al (2003) and Chiu et al. (2006) it might be that disagreement in vision stimulates an ongoing discussion, refines knowledge and improve an innovative idea.

Furthermore, the role of the facilitator is not incorporated in the model but seemed rather important for knowledge sharing in the results of this review as in previous literature (Bermejo-Caja et al., 2019). This is because they can steer and direct the VCoP mainly on two levels, namely two levels: the level of relevant content and the level of community building. However, one could argue that ideally, a facilitator has a big role at the starting phase of a VCoP but less in a more developed stage, since it would be positive for on the long run if a VCoP is not fully dependent on one or more facilitators, but is also successful due to the motivations of its member.

Implications for practice

Accordingly to the included literature of this review, a VCoP has the potential to be a useful method for sharing knowledge about user innovation. However, some barriers should be overcome to prevent a VCoP from failing. When building and running an active VCoP it is important to take the following notions into account which are suggested by the findings of this review of the literature. First of all, the problem of an experienced lack of time by health professionals. Secondly, the VCoP should have an easy design, so health professionals won't experience a lack of technical knowledge and skills for using it. Furthermore, the importance of a facilitator should not be underestimated. The different tasks of such a facilitator can overcome several barriers for health professionals to contribute knowledge. Besides, the literature suggests it would be beneficial for knowledge contribution when the facilitator and the VCoP are facilitating asynchronous methods of communication. Finally, the concept of trust should be considered when building or facilitating a VCoP. Fostering trust is possible through the role of the facilitator, who stimulates an open environment and a sense of community and keeps the right focus of the VCoP. In addition to that, the VCoP should be high in responsiveness and their members should have disposition to trust. Finally, members can show some personal information for instance on their profiles within the VCoP to build trust for a successful VCoP.

Limitations

Limitations of this literature review include the number of articles that are found through snowballing. Six out of seventeen articles is a relatively large amount. The consequence is that the snowballed articles referred to the first included articles in the selection process which might have caused a more narrow view on the broadness of the existing literature. Second, the term Community of Practice was included in the search query which led to a lot of articles that did not fit with the exclusion criteria on physical communities and had therefore been excluded. Finally, within this literature review partly due to feasibility, no distinction is being made in the type of profession that the health professionals practiced. For example, a GP may encounter different barriers and stimulators than a surgeon. Not only the hospital or non-hospital context may influence the VCoP, but a difference can also exist in for example nurses or doctors, one could also research after the effectiveness of a multidisciplinary VCoP versus a homogeneous VCoP. A VCoP that goes beyond major geographical location, cultural barriers even online, can have a major influence. Therefore it may be interesting for future research to focus on different types of VCoPs.

Conclusions and future directions

The importance of knowledge sharing, including the sharing of user innovation is widely recognized. This literature review gave insight into the existing barriers and stimulators that are identified in the literature. This research first proposed the channel of a VCoP because it could be the right fit for a non-time consuming way of sharing user innovations. However, a lack of time appeared to be a major barrier for knowledge contribution in a VCoP. Still, it might have the potential to be an efficient diffusion channel, when future research focuses on how to make VCoPs less time consuming, fostering trust, better integrated into the organizational context and on how to increase the awareness on the value of spending time on knowledge sharing. Since it is apart from being beneficial for society, also beneficial for the health professional.

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7. Appendix

Author (Year)	Title	Study design	Country	Sample size	Quality assessment	Outcome(s)
Ardichvili, A., Page, v. & Wentling, T. (2003)	Motivation and barriers to participation in virtual knowledge-sharing communities of practice	Qualitative case study	-	30 respondents	High	Stimulator: <ul style="list-style-type: none"> - Social interaction ties increased individuals quantity of knowledge sharing Barrier: <ul style="list-style-type: none"> - A shared vision had a negative strong influence on the quantity of knowledge sharing
Barnett, S., Jones, S.C., Bennett, S., Iverson, D. & Bonney, A. (2012)	General practice training and virtual communities of practice	Literature review	-	23 articles	High	Stimulators: <ul style="list-style-type: none"> - Most VCoP used a facilitator or moderator, these are overlapping but different roles - Clear/specific objective motivates to contribute - The VCoP should be risk-free and safe - Perceived ease of use - Email reminders - Asynchronous method of communication - Self-selection Barrier: <ul style="list-style-type: none"> - Password barrier
Bertone, M.P. et al. (2013)	Assessing communities of practice in health policy: A conceptual framework as a first step towards empirical research	Literature review	-	25 articles	Medium	Stimulators: <ul style="list-style-type: none"> - Importance of the role of facilitator by: defining objectives of the CoP & Create environment conducive to knowledge exchange - Level of trust - Regulatory mechanisms - Power structure - Ownership
Chiu, Ch.M., Hsu, M.H. & Wang, E. (2006)	Understanding knowledge sharing in virtual communities: An integration of social capital and social cognitive theories	Cross-sectional survey	Taiwan	310 respondents	High	Barriers: <ul style="list-style-type: none"> - Individuals contribute less knowledge, even though they expect that KS will produce desirable consequences to them.

						<ul style="list-style-type: none"> - Trust did not have a significant impact on quantity - A negative path between shared vision and quantity of KS and positive on the quality <p>Stimulators:</p> <ul style="list-style-type: none"> - Social interaction ties, reciprocity and identification increases individuals quantity of knowledge - Community-related outcome expectation had a strong positive effect on the quantity of knowledge quality
Curran, J.A., Murphy, A.L., Raza Abidi, S.S., Sinclair, D. & McGrath, P.J. (2009)	Bridging the Gap: Knowledge Seeking and Sharing in a Virtual Community of Emergency Practice	Case study	Canada	107 survey respondents 54 participants in posting	high	<p>Barriers:</p> <ul style="list-style-type: none"> - Lack of time - Lack of technical knowledge and skill - Difficulty using password
Evans C., Yeung E., Markoulakis R. & Guilcher S. (2014)	An online community of practice to support evidence-based physiotherapy practice in manual therapy	Qualitative approach	Canada	19 participants	High	<p>Stimulators:</p> <ul style="list-style-type: none"> - Instructional design features, guiding questions and collaborative assignments - Role of facilitator - Intrinsic motivation of participants
Falkman G., Gustafsson M., Jontell M. & Torgersson O. (2008)	SOMWeb: A semantic web-based system for supporting collaboration of distributed medical communities of practice	Mixed methods		9 respondents (interview) 24 respondents (questionnaire)	High	<p>Barriers:</p> <ul style="list-style-type: none"> - Lack of time - Lack of access to online articles for smaller hospitals
Friberger M.G. & Falkman G. (2013)	Collaboration processes, outcomes, challenges and stimulators of distributed clinical communities of practice	Mixed Methods		9 respondents (interview) 24 respondents (questionnaire)	High	<p>Stimulators:</p> <ul style="list-style-type: none"> - The champion as an enabler - Participation of experts
Hara N. & Hew K.F. (2007)	Knowledge-sharing in an online community of health-care professionals	In-depth Case Study, Mixed Methods		27 respondents	High	<p>Stimulators:</p> <ul style="list-style-type: none"> - Self-selection - Validation of one's practice - Better understanding of current knowledge, best practice in field - Non-competitive environment - Asynchronous nature of the online communication

						<ul style="list-style-type: none"> Medium - Role of moderator
Hurtubise, K., Rivard, L., Héguay, L., Berbari J. & Camden, C. (2016)	Virtual Knowledge Brokering: Describing the Roles and Strategies Used by Knowledge Brokers in a Pediatric Physiotherapy Virtual Community of Practice	Evaluation of a VCoP	Canada	95 posts 45 participants	High	Stimulators: <ul style="list-style-type: none"> - Role of KB 1) context architect, 2) promoter of knowledge sharing, and 3) linkage creator - Sense of community
Ikioda, F., Kendall, S., Brooks, F., De Liddo, A. & Buckingham Shum, S. (2013)	Factors That Influence Healthcare Professionals' Online Interaction in a Virtual Community of Practice	Case Study	United Kingdom	Amount of participants started at 30 and in the end 106	High	Stimulators: <ul style="list-style-type: none"> - Encouraging new members to join, encourages more enthusiastic members to contribute - Moderator - Topics should be relevant to daily practice
Lacasta Tintorer D., Flayeh Beneyto S., Manresa J.M., Torán-Monserrat P., Jiménez-Zarco A., Torrent-Sellens J. & Saigí-Rubió F. (2015)	Understanding the discriminant factors that influence the adoption and use of clinical communities of practice: The ECOPIH case	Case Study	Spain	166 respondents	High	Stimulators: <ul style="list-style-type: none"> - Perceived usefulness for reducing costs - Perceived usefulness for improving clinical practice quality - Habitual social media website and application use
Lacasta Tintorer, D., Dominguez, J.M.M., Pujol-Rivera, E., Beneyeto, S.F., Tuduri, X.M. & Saigi-Rubio, F. (2018)	Keys to success of a community of clinical practice in primary care: a qualitative evaluation of the ECOPIH project	Descriptive-interpretative quality study	Spain	29 healthcare professionals	High	Barriers: <ul style="list-style-type: none"> - Lack of time - Little recognition - Not integrated into workstations - Password Stimulators: <ul style="list-style-type: none"> - Speed, efficiency - Reliable, up-to-date information - PC leadership
Majewski, G. & Usoro, A. (2011)	Barriers of and incentives to knowledge sharing in (Virtual) Communities of Practice: A critical literature review	Literature Review		-	Medium	Barriers: <ul style="list-style-type: none"> - Risk - Fear of losing face - Fear of different costs - Lack of trust - Time constraints - Inadequate technology Stimulators: <ul style="list-style-type: none"> - Trust - Perceived Benefits - Reciprocity

						<ul style="list-style-type: none"> - Perceived relative advantage of knowledge sharing - Perception of community - Leaders - Multiple communication channels -
Mazer B., Kairy D., Guindon A., Girard M., Swaine B., Kehayia E. & Labbé D. (2015)	Rehabilitation living lab in the mall community of practice: Learning together to improve rehabilitation, participation and social inclusion for people living with disabilities	Mixed methods	Canada	43 participants 26 participants in online platform	High	Barriers: <ul style="list-style-type: none"> - Lack of familiarity with technology - Limited online participants - Lack of time Advantages <ul style="list-style-type: none"> - An ongoing discussion is possible - A central place to keep track of information
McLoughlin, C., Patel, K.D., O'Callaghan, T. & Reeves, S. (2018)	The use of virtual communities of practice to improve interprofessional collaboration and education: findings from an integrated review	Integrated review	-	19 articles	High	Barriers: <ul style="list-style-type: none"> - Concerns about patient information, privacy, and security - Organizations with steep vertical hierarchy - Lack of time - Trust - Ease of use Stimulators: <ul style="list-style-type: none"> - A positive and encouraging environment - Use of face-to-face meetings - Desire to share knowledge - Homogenous or focused VCoP - Facilitators - Asynchronous communication
Stewart, S.A. & Abidi, S.S.R. (2012)	Applying social network analysis to understand the knowledge sharing behaviour of practitioners in a clinical online discussion forum	Case study	-	568 posts studied	High	Stimulators: <ul style="list-style-type: none"> - Self-motivation - Demonstration value of knowledge sharing - Champions or leaders

Table 10: Overview of the included studies