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Contents

Knowledge Translation in the Healthcare Sector. A Structured Literature Review

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Abstract: Knowledge translation can be understood as the ability to translate concepts between different contexts by stakeholders who have different skills, aims, and even feelings in their relation to such concepts. Knowledge translation tools allow for the effective transfer of existing knowledge as well as the emergence of new knowledge of value to some or all of the stakeholders involved in the process. Knowledge translation is particularly challenging in healthcare and medicine, where different practitioners (e.g. physicians, biologists, engineers, researchers) and professionals need methodologies and tools to communicate and share knowledge among them and with patients in an effective manner. To better understand this phenomenon, we conducted a Structured Literature Review (SLR). The concepts *knowledge*, *translation* and either *healthcare* or *medicine* were used as search terms in the title, abstract or keywords on Scopus, which highlighted more than 2,000 contributions in the medical literature and only 22 in Business and Management. Our review of these documents revealed a need in the healthcare sector for better managerial and organisational practices to cope with the various challenges related to the sharing of knowledge among stakeholders. At the same time, the business and management communities appear to have made significant progress in addressing the same issues. We therefore decided to concentrate our analysis on the works published by the business and management community as a mean to highlight future research directions for the healthcare management sector. Thus, our research identifies areas of relevance which are currently underdeveloped, provides insights on both theoretical and empirical developments and offers a critique of the approaches, research frameworks and methods used, as well as emerging trends in these domains. Despite a lack of an agreed definition of the term Knowledge Translation, our findings highlight a growing interest in the topic, with most of the contributions published after 2015. Scholars have approached the term from a variety of perspectives depending on the nature of the stakeholders of relevance to their studies. Whilst there does not seem to be a predominant framework, the literature reveals several tools and techniques that are effective in enhancing Knowledge Translation in different contexts. New research opportunities in this domain emerge in terms of underinvestigated areas within the healthcare sector.

Keywords: Knowledge Translation, Healthcare, Knowledge Management, Knowledge Transfer • Medicine

1. Introduction

Knowledge management stands as a crucial business process in both the private as well as the public sector(Aureli et al., 2019; Del Giudice and Maggioni, 2014; Massaro, Dumay, and Garlatti, 2015; Sousa, 2010). Among the various fields, healthcare stands as a critical one, given its ability to impact on people's lives and wellbeing (Reay *et al.*, 2017; Ware *et al.*, 2008). The relevance of knowledge and its management in the healthcare scenario has been widely investigated in the literature (Ferlie *et al.*, 2015; Jacquinet *et al.*, 2019; Miller, 2015; Sánchez-Polo *et al.*, 2019; Sousa *et al.*, 2020).

Still, the healthcare sector is currently under great pressure, and several challenges to be addressed have arisen. The impact of new technologies like mixed and augmented reality, artificial intelligence, robotics, big data analytics are affecting several medical disciplines, changing the way surgery, diagnosis, and treatments are performed (Dal Mas, Piccolo and Ruzza, 2020; Dal Mas et al., 2020b; Dal Mas et al., 2019b; Giulianotti et al., 2003; Presch et al., 2020).Innovation involves not only new medical equipment and instruments but also

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clinical protocols, like in the case of oncology (Cobianchi *et al.*, 2016; Hogan *et al.*, 2012; Vitolo *et al.*, 2019). Medical doctors and clinical staff require new skills and training methods (Garcia Vazquez *et al.*, 2020), and blended curricula are leading to new professional figures, like technical physicians (Groenier, Pieters, and Miedema, 2017). Several budget reductions, especially in developed countries (Massaro, Dumay, and Garlatti, 2015) make it difficult to cope with the increasing request for outpatient and inpatient services by an ageing population (Howdon and Rice, 2018) with more chronic diseases (Miceli *et al.*, 2017). The recent COVID-19 pandemic at the beginning of 2020 (WHO, 2020) has furthered highlighted the need, for the entire healthcare system, to profoundly review its global strategies (Cobianchi et al., 2020a, 2020c).

In this evolving international scenario, the healthcare ecosystem had to open up its boundaries to the engagement and the interaction of several different stakeholders (Ardito and Messeni Petruzzelli, 2017; Secundo *et al.*, 2019). Not only multidisciplinary and diverse teams are more and more involved in clinical practices and medical innovation (Cobianchi et al., 2020b; Qadan et al., 2020; Saini et al., 2012), but the patient plays a central role in the co-production of the healthcare products or services (Batalden *et al.*, 2016; Elwyn *et al.*, 2019). In the modern healthcare scenario, patients are more and more engaged in the co-design (Hussain and Sanders, 2012; Reay *et al.*, 2017) and co-production of their needed services (Biancuzzi et al., 2020; Dal Mas et al., 2020a), in a patient-centric perspective (Brunoro-Kadash and Kadash, 2013).

The transfer and sharing of knowledge stand as key tasks to ensure the creation of new knowledge and innovation (Sousa, 2015). Still, the presence of a variety of stakeholders with different characteristics makes it challenging to manage the knowledge flows properly (Sousa *et al.*, 2020). Distinct features in terms of competencies, needs, feelings, education create barriers in the transfer and sharing of knowledge, calling for a translation process to enable knowledge, data, and information to be understood and exchanged successfully.

The topic of knowledge translation is gaining increasing attention both from academia as well as practice due to its crucial role in supporting innovation in various business fields (Lander, 2016). Savory (2006) highlights how the social nature of knowledge needs something more than a “knowledge transfer.” A complete translation is necessary, recalling the idea of a foreign language which is translated into another language in a different environment (Simeone, Secundo and Schiuma, 2017, 2018). The translation act recalls metaphorical thinking (Bratianu and Bejinaru, 2019; Lakoff and Johnson, 1999), as part of a mental process to understand and handle new knowledge and information (Pinker, 2007).

While the topic of knowledge translation is considered relevant in several business fields (Bagnoli *et al.*, 2020; Massaro *et al.*, 2019; Simeone *et al.*, 2018), it is even more prevalent in healthcare and medicine. At the time of our analysis, the search key "knowledge AND translation AND healthcare OR medicine" in the title, abstract, or keywords on the scientific database Scopus led more than 3,000 contributions of which over 2,000 in the medical and clinical literature. Still, just a few contributions were labelled under the business and management fields.

Our initial thought was that the topic had been better developed in healthcare than it was in business and management. However, an initial analysis revealed how many of those works published in healthcare had mentioned knowledge translation as a challenge in the context of the research, rather than focusing on it as part of solutions. Additionally, those works from the healthcare sector that were focused on the concept of knowledge translation were reporting research conducted in business and management.

In these circumstances, we concluded that there was more value for the research and practice communities in a review of a smaller number of highly relevant contributions from the business and management domain than a larger, less focused and therefore less productive review of the research in the healthcare sector which, ultimately, would only confirm the need for a review of works published in other contexts.

Moreover, the recent challenges and events which are impacting on the healthcare scenario, including the COVID-19 pandemic, have stressed the need to identify successful managerial practices to redesign the new healthcare system (Lillemoe, 2020). Furthermore, the recent clinical literature connected to the COVID-19 events has suggested the need for a multidisciplinary approach to medicine (Brindle and Gawande, 2020; Cobianchi et al., 2020c; Grasselli, Pesenti, and Cecconi, , 2020; Qadan et al., 2020), in which managerial practices and strategies play a central role (Cobianchi et al., 2020a; Cobianchi et al., 2020c; Parodi and Liu, 2020; Wang, Ng, and Brook, 2020).

Starting from these premises, this paper aims to investigate the current debate on knowledge translation in healthcare and medicine by conducting a Structured Literature Review (SLR), according to the framework of Massaro, Dumay, and Guthrie (2016). Our first attempt to map the phenomenon, taking into consideration the need to study it from a managerial perspective, includes only the works published in the Business and Management field, meaning in journals or books which are labelled to belong to the Business and Management areas. The aim is to understand the dialogue about the managerial and organisational practices involving organisations belonging to the healthcare sector in the translation of knowledge among the business rather than the clinical community, to spot the most relevant topics, techniques, and research and practical implications. Our preliminary analysis made us understand how exploring the subject in the context of Business and Management (particularly if related to healthcare organzations) would serve to inform the direction of research in the healthcare sector.

2. Research method

This paper employs a Structured Literature Review approach (Massaro, Dumay, and Guthrie, 2016). An SLR "can help experienced scholars develop new and interesting research paths by accessing and analysing a considerable volume of scholarly work" (Massaro, Dumay, and Guthrie, 2016). Moreover, it can "contribute to developing research paths and questions by providing a foundation" for future research activities, by providing a different choice to classic literature reviews to lead to more "defensible" and "replicable" outcomes.
The following paragraphs summarise the steps undertaken to conduct the SRL.

2.1 Write a literature review protocol and define the questions that the literature review is setting out to answer

A first preliminary protocol was defined to document the procedures followed in undertaking and in developing the literature review, and in making it repeatable and trustworthy. The initial protocol document contributed to identifying three central research questions.

RQ 1: What are the main features of the literature on knowledge translation in healthcare and medicine, seen from a managerial perspective?

RQ 2: What are the most frequent issues and themes/topics of this literature?

RQ 3: What seem to be the possible implications for future research in this field?

2.2 Determine the type of studies and carry out a comprehensive literature research

We used the database Scopus to identify relevant contributions to be analysed. At the time of the study, the search key "knowledge AND translation AND healthcare OR medicine" in the title, abstract, or keywords on Scopus led to more than 3,000 total contributions of which over 2,000 in the medical and clinical literature and only 22 in Business and Management. Of those 22 between papers and book chapters, 18 have been considered appropriate for the analysis and thus have been coded using Nvivo.

The following table summarises the selected contributions included in the SLR. One first result comes once browsing the year of publication. While the earliest work is dated back in 2008, ten contributions (55% of the sample) were published after 2015, highlighting the increasing interest towards the topic.

Table 1: Authors, articles, and sources

Authors	Title	Year	Source title
Karimi, L., Dadich, A., Fulop, L., Leggat, S.G., Eljiz, K., Fitzgerald, J.A., Smyth, A., Hayes, K.J., Kippist, L.	Brilliant health service management: challenging perceptions and changing HR practices in health services	2019	Asia Pacific Journal of Human Resources
Fulop, E.L., Kippist, L., Dadich, A., Hayes, K., Karimi, L., Symth, A.	What makes a team brilliant? An experiential exploration of positivity within healthcare	2019	Journal of Management and Organization
Grigoriadis, N., Bakirtzis, C., Politis, C., Danas, K., Thuemmler, C., Lim, A.K.	A health 4.0 based approach towards the management of multiple sclerosis	2017	Health 4.0: How Virtualization and Big Data are Revolutionizing Healthcare
Currie, J., Mateer, J., Weston, D., Anderson, E., Harding, J.	Implementation of a clinical governance framework to 17 Combat Service Support Brigade, Australian Army	2017	International Journal of Health Governance
Mohaghegh, N., Zarghani, M., Tahamtan, I., Ghasghaee, A., Mousavi, S.	Assessing knowledge translation in Iranian medical research centres	2017	International Journal of Information Science and Management
Dadich, A., Olson, R.E.	How and why emotions matter in interprofessional healthcare	2017	International Journal of Work Organisation and Emotion
D'Andreta, D., Marabelli, M., Newell, S., Scarbrough, H., Swan, J.	Dominant Cognitive Frames and the Innovative Power of Social Networks	2016	Organization Studies
Lander, B.	Boundary-spanning in academic healthcare organisations	2016	Research Policy
Dadich, A., Abbott, P., Hosseinzadeh, H.	Strategies to promote practice nurse capacity to deliver evidence-based care: An example from sexual healthcare	2015	Journal of Health, Organisation and Management
Avila-Robinson, A., Islam, N.	Evolution of emerging iPS cell-based therapies for age-related macular degeneration (AMD)	2015	Portland International Conference on Management of Engineering and Technology
Radaelli, G., Lettieri, E., Mura, M., Spiller, N.	Knowledge sharing and innovative work behaviour in healthcare: A micro-level investigation of direct and indirect effects	2014	Creativity and Innovation Management
Oborn, E., Barrett, M., Racko, G.	Knowledge translation in healthcare: Incorporating theories of learning and knowledge from the management literature	2013	Journal of Health Organization and Management
Brunoro-Kadash, C., Kadash, N.	Time to care: A patient-centered quality improvement strategy	2013	Leadership in Health Services
Baigorri, A., Villadangos, J., Astrain, J.J., Córdoba, A.	A medical knowledge management system based on expert tagging (MKMST)	2013	WIT Transactions on Information and Communication Technologies
Komporozos-Athanasiou, A., Oborn, E., Barrett, M., Chan, Y.E.	Policy as a struggle for meaning: Disentangling knowledge translation across international health contexts	2011	Knowledge Management Research and Practice
Ioannidis, J.P.A.	Limits to forecasting in personalized medicine: An overview	2009	International Journal of Forecasting
Savory, C.	Building knowledge translation capability into public-sector innovation processes	2009	Technology Analysis and Strategic Management
Ware, C., Buckwell, C., Small, S., Wood, R.	Activation of evidence: A new approach to knowledge translation and closing the clinical care gap	2008	Journal of Medical Marketing

2.3 Define an analytical framework

A fundamental step in conducting an SLR is the definition of a framework of analysis. The list of the leading nodes and sub-nodes is taken from previous SLR papers, adapted to the aim of the study.

The first category of nodes is about the type of authors, dividing them into scholars vs practitioners. The second category refers to the location where the study is conducted (Massaro, Dumay, Garlatti, 2015). The third category is about the sector type, dividing it into public and private sectors. The fourth group of nodes

refers to the healthcare sector, while the fifth one is about the healthcare service. The sub-nodes of the fourth and fifth category were added while coding the papers. The sixth category concerns the research methodology used in the study (Dal Mas et al., 2019a; Massaro, Dumay, and Garlatti, 2015). The seventh category analyses the framework model used (Dal Mas al., 2019a; Massaro, Dumay, and Garlatti, 2015; Massaro et al., 2016). The eighth node group maps the type of knowledge translation explained in the research and the eventual definition given. The ninth category analyses the knowledge translation tools cited in the various studies. The tenth category is about the eventual explanation of the findings. The last three categories refer to the eventual research, practical, and policy implications.

The following table summarises the framework model and the main results of the coding.

Table 2: Analytical framework

Category	Variables	Results	%
Author type	Scholars	15	83%
	Practictioners	1	6%
	Practitioners and scholars	2	11%
Location	Continental Europe	2	11%
	UK	2	11%
	Australia	5	28%
	North America	2	11%
	Central South America	0	0%
	Asia	1	6%
	Africa	0	0%
	New Zealand	0	0%
	Russia	0	0%
	Various countries together	1	6%
	No Location	5	28%
Sector type	Public Sector	13	72%
	Private Sector	1	6%
	Both private and public sector	0	0%
	General	4	22%
Healthcare Sector	Scientific and Clinical Research	3	17%
	Hospitals	4	22%
	Army	1	6%
	Government agencies	5	28%
	Interprofessional Practices	1	6%
	E-Health	1	6%
	Academic Healthcare Organizations	1	6%
	General	1	6%
	Pharma	1	6%
Healthcare Service	Regenerative Medicine	1	6%
	Radiology	1	6%
	Neuroscience	1	6%
	Governamental Army	1	6%
	Governamental Networks	1	6%
	Primary Healthcare	1	6%
	Oncology	2	11%
	Multiple Sclerosis	1	6%
	Personalised Medicine	1	6%
	Quality Healthcare	1	6%
	Stroke	1	6%
	Infection and immunology	1	6%
	General Clinical Research	1	6%

Category	Variables	Results	%
	General	2	11%
	Palliative care	1	6%
	Pharma	1	6%
Research Method	Quantitiave cross-sectional	3	17%
	Case Study	4	22%
	Literature review - normative	2	11%
	Other qualitative	2	11%
	Viewpoint	2	11%
	Mixed methods	2	11%
	Interviews	2	11%
	Discourse Analysis	1	6%
Framework	No framework-model used	6	33%
	Applies previous framework	10	56%
	Proposes a new framework-model	2	11%
Definition of Knowledge Translation	Type of KT	16	89%
	No	0	0%
	Clear definition	6	33%
Knowledge Translation tools	Yes	18	100%
	No	0	0%
Findings	Explains findings	15	83%
	Not explained	3	17%
Research implications	Explains research implications	8	44%
	Not explained	10	56%
Practical implications	Explains practical implications	13	72%
	Not explained	5	28%
Policy implications	Explains policy implications	7	39%
	Not explained	11	61%

3. Findings, insights and critique

This section analyses the coding to answer to RQ1: What are the main features of the literature on knowledge translation in healthcare and medicine, seen from a managerial perspective? and RQ2: What are the most frequent issues and themes/topics of this literature?

3.1 Author types

Scholars wrote almost all the papers. Practitioners authored only one article, and just two works are the joint effort of scholars and practitioners together.

3.2 Location

Interesting enough, five papers are about Australia. Continental Europe, the UK, and North America account for two studies each. Only one work comes from Asia. Several articles do not refer to any locations. No studies were conducted in Africa or Central/South America.

3.3 Sector type

Most papers refer to the public sector. Only one paper is about the private sector.

3.4 Healthcare Sector

The most analysed sectors are government agencies (five works), hospitals (four works), and scientific and clinical research (three works). Additional sectors are investigated but only with one article.

3.5 Healthcare Service

As can be seen from Table 2, results are incredibly fragmented. Only oncology and healthcare in general terms are present in two papers.

3.6 Research Methods

There does not seem to be a dominant research method used. Authors use quantitative as well as qualitative studies, and there are literature reviews and viewpoints as well.

3.7 Framework model

Although six papers do not use or clarify the framework model used, most of the authors declare to use an existing framework. However, all models are different, since there is no framework which is used more than one time.

The key frameworks that are currently used in the literature include, among others: institutional theory (Dadich and Olson, 2017), critical discourse analysis (Komporozos-Athanasiou *et al.*, 2011), mode 2 knowledge production (Savory, 2009), linear translation by Nelson at al. (2011) and Morlacchi and Nelson (Avila-Robinson and Islam, 2015; 2011)

3.8 Definition of Knowledge Translation

Interesting enough, the types of knowledge translation are defined in several ways, according to the stakeholders and actors involved. Indeed, it can be seen as the translation:

- from science to clinical results (four results); meaning the translation of scientific research into clinical practices (like new medical protocols, pharmaceutical treatments, or surgical techniques);
- from the physician to the patient (one result), meaning the translation of clinical knowledge (e.g. diagnosis, potential treatments, risks, …) from the healthcare professional to the sick person;
- from the patient to the physician (one result), meaning the translation of the feelings, priorities, goals, concerns from the ill person to his or her medical consultant;
- among scientists and professionals in the healthcare/clinical setting (three results), meaning the translation of scientific knowledge within professionals of different disciplines or backgrounds, which may include, as an example, various clinical specialities, engineering, biology, management, physics while dealing with a healthcare issue or research;
- from the central government to single units (one result), meaning the translation of healthcare policies, regulations, and guidelines;
- in general terms (eight results).

Only six articles clearly define the concept of "knowledge translation," some of them citing other works. Results are reported in the following table.

Table 3: Definition of Knowledge Translation

Paper	KT definition
Dominant Cognitive Frames and the Innovative Power of Social Networks (D'Andreta *et al.*, 2016)	'Knowledge Translation' is the process through which research findings can be applied in medical practice (Denis and Lomas, 2003; McAneney *et al.*, 2010).
Strategies to promote practice nurse capacity to deliver evidence-based care An example from sexual healthcare (Dadich, Abbott, and Hosseinzadeh, 2015)	Knowledge translation is "any activity or process that facilitates the transfer of high quality evidence from research into effective changes in health policy, clinical practice, or products" (Lang, Wyer, and Haynes, 2007, p. 355).
Policy as a struggle for meaning: disentangling knowledge translation across international health contexts (Komporozos-Athanasiou *et al.*, 2011)	Translating evidence into practice
Assessing Knowledge Translation in Iranian Medical Research Centres (Mohaghegh *et al.*, 2017)	"Knowledge translation" is defined as turning knowledge into action which includes "knowledge creation" and "knowledge application" to improve taking advantage of research benefits (Graham *et al.*, 2006)
Knowledge translation in healthcare Incorporating theories of learning and knowledge from the management literature (Oborn *et al.*, 2013)	The process of "knowledge translation" includes knowledge dissemination, communication, technology transfer, ethical context, knowledge management, knowledge utilisation, two-way exchange process between researchers and those who apply knowledge, implementation research, and development of consensus guidelines (Canadian Institutes for Health Research - CIHR). A few years later, the World Health Organization (2006) adapted the

Paper	KT definition
	CIHR's definition and defined knowledge translation as "the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people's health."
Knowledge Sharing and Innovative Work Behaviour in Healthcare: A Micro-Level Investigation of Direct and Indirect Effects (Radaelli *et al.*, 2014)	During idea promotion, individuals do not merely transmit information and data about the proposed innovation, but must also 'translate' these into a form that is understandable and palatable for other individuals and teams

3.9 Knowledge translation tools

The literature identifies 32 different knowledge translation tools and methods, which can foster or enhance the effective knowledge transfer and thus the creation of new knowledge and outcomes. Among the most frequent ones, we may mention online medical records (3 references), web portals (3 references), lesson learned and best practices (5 references), committee and meetings (3 references), mixed and interdisciplinary teams (5 references), training (6 references), interpersonal skills (5 references), and the use of testimonials (3 references). Full results are reported in the following table.

Table 4: Summary of Knowledge Translation tools

Knowledge Translation Tool	Details	Sources
The pathogenesis and mechanisms behind diseases	The use of epidemiological observations to understand the underlying causes of a disease	1
Mobile electronic Medical records and online tools	The use of online or cloud-based apps or systems	3
Design	The use of design elements and artefacts like sketches and images	2
Web portals	The use of online web sites and other web tools	3
Image tagging	The use of clinical imaging	2
Lesson Learned and Best Practices	The use or identification of past conducts which proved to be successful or not, and that should or should not be replicated	5
Tours to share experiences with others	Visiting in person other institutions, hospitals, or organisations	1
Committees and meetings	The establishment of dedicated groups or group gathering to discuss specific topics	3
Journal publications	Dissemination through publishing in academic or non-scientific reviews, journals, magazines, newspapers	2
In-person visit and talking	The use of face-to-face meetings with dedicated time	1
Establishment of mixed teams	The creation of working teams made of diverse people, including professionals with different expertise, skills, and specialities	5
Co-production	The engagement of more meaningful stakeholders, including patients, who take an active part in the production of the healthcare product or service	2
Leaflets and brochures	The use of printed or online booklets devoted to one or more specific topics	1
Training	The organisation of dedicated courses or classes	6
Clinical cases	Explanations using past clinical case reports	2
Clinical guidelines	Explanations using guidelines issued by medical scientific societies	1
Use of interpersonal skills	The use of soft skills like empathy, leadership, teamwork	5
Discussions, debates, curiosity	Time devoted to in-group talks	1
New Technological tools	The use of modern technologies	2
Mentoring and leadership	Dedicated time to guide, teach, and assess other people	1

Knowledge Translation Tool	Details	Sources
Testimonials	The engagement of famous or reputable people, whose knowledge or role is well recognised in one specific field	3
Engaging with the patient's family	Including the patient's family members in the discussion or decision-making process	1
Empowerment	Giving more relevant roles to people	2
Tensions	Understanding eventual paradoxes to foster decision-making	1
Community of practice	The use of a group of people to share knowledge and learn	1
Multidisciplinary people (Eg. degree in medicine + IT)	Getting people with more than one meaningful skills or expertise within the team	1
Use of evidence-based methods	The use of methods which are backed up by objective, scientific evidence that proves they are effective	2
Quality assessment by stakeholders	Asking meaningful stakeholders to judge the quality of one product, service, or process according to certain standards or key performance indicators	2
Prototyping	Using a first or preliminary version of a device starting from its project, from which other forms may be developed.	2
Simulations	Imitating a situation or process, to assess the potential results or outcomes	1
Self-assessment	Self-evaluating the quality of one product, service, or process according to certain standards or key performance indicators	2
Use of simple language	Avoiding technical terms, and replacing them with words from common language	1

3.10 Findings, research implications, practical implications and policy implications

Most papers explain the findings. Most interesting, while several articles stress how knowledge translation can be used in a practical way, just a few works highlight the eventual policy and research implications of the study.

4. Discussion and implications

This section aims to discuss the main findings to answer RQ3: What seem to be the possible implications for the research in this field of knowledge translation in healthcare and medicine? In trying to reply to this issue, we try to develop and address some emerging themes as outlined next.

4.1 Implication 1: practitioners should be involved in the dialogue

Scholars authored most papers, and there is limited involvement of practitioners in the dialogue. This evidence contributes to stress the academics and practitioners divide. While scholars typically use robust methodological approaches, practitioners use real knowledge translation tools in practice to achieve their own ends (Massaro *et al.*, 2018). Given the practical aim of knowledge translation and its wide field of application in healthcare and medicine, stronger cooperation between academics and professionals should be recommended (Presch *et al.*, 2020; Renaudin *et al.*, 2018). Multidisciplinary research teams, merging scholars and practitioners with different skills and experience may be advised, as recommended by the most recent literature, especially following the COVID-19 experience (Albutt et al., 2020; Cobianchi et al., 2020c; Qadan et al., 2020).

4.2 Implication 2: some areas of the world are more investigated than others

Although our sample is limited, there are areas of the world which are over investigated, while others are absent or underinvestigated. Our literature review highlights the presence of several studies conducted in Australia, which may mean that the topic of knowledge translation is considered relevant in Australian institutions. The UK, continental Europe, and North America are investigated by some works. No studies have been conducted in Africa and Latin America, and only one article analyses Asia. This opens up to new research

opportunities to investigate organisations in such locations and share eventual knowledge translation tools or best practices which may be useful also elsewhere in the world. Comparative studies may also be recommended, as only one paper investigates more countries together. Part of the literature analyses the topic of knowledge translation in general terms, without binding it to some specific location. This may mean that, in the Business and Management community, there is still interest towards a general discussion about knowledge translation as a theoretical topic, which dominant framework still needs to be clarified.

4.3 Implication 3: the private sector deserves attention

Our literature review highlights how almost all studies are about the public sector. This may be due to the availability or access to data by authors, most of whom are academics, as underlined in section 5.1. However, healthcare is a wide field that includes several institutions, firms, clinics, labs, and private universities that belong to the private sector. Understanding the knowledge translation processes in such organisations may open up to further research horizons. In a healthcare system which is becoming more and more interdisciplinary, blended situations are present, in which public and private healthcare institutions and companies cooperate. Understanding the knowledge translation dynamics may open up to further research avenues, and suggest new enablers and techniques which may be useful in practice. In such a perspective, the dialogue between academics and practitioners stand a key point in ensuring the more exciting results, which are linked to real-world situations.

4.4 Implication 4: several healthcare services are investigated

As reported in the previous sections, papers investigate several different healthcare services: from regenerative medicine to stroke, from pharma to palliative care. Only oncology and healthcare in general terms are analysed in more than one contribution. We may then highlight how much the topic of knowledge translation is transversal when it comes to healthcare and medicine, and the potential practical areas of investigation may be several.

4.5 Implication 5: there is a lack of a dominant framework

Section 4.7 has highlighted the absence of a dominant framework model, as no scheme is used in more than one paper. The fragmentation of the literature implies that there is the opportunity to study a common framework that may be used to compare studies and support managers and policymakers towards a useful integrated knowledge translation model. This idea is also supported by the relatively high number of general papers, which are not linked to a specific location, as reported in section 4.2.

4.6 Implication 6: there is not a common definition of knowledge translation

As for the framework model, there does not seem to be a unique definition of knowledge translation. Most articles even do not define it. Again, there is a research opportunity, to sum up previous descriptions to reach a standard paradigm, or, at least, to summarise the main points beyond the metaphorical language used (Bratianu and Bejinaru, 2019)

4.7 Implication 7: there is an open list of knowledge translation tools

Interestingly, even a limited sample of 18 publications led to 32 different knowledge translation tools and methodologies. Some of them seem more common, as they are mentioned in more works, some others are cited by only one article. As highlighted before, knowledge translation tools represent the engine to grant effective knowledge sharing, transfer, and the creation of new knowledge and outcomes. Identifying knowledge translation tools and how they can work in-action leads to practical implications, which may allow theory to be effective in the real world. There is indeed a need to collect more knowledge translation tools and methodologies and understand their dynamics in healthcare organisations, evaluating as they do work in action. Further studies investigating how some enablers and techniques work in practice may contribute to the theoretical debate, as well as to real-world implications.

5. Conclusions

In ending our work, we want to start from the premises of the study. We wanted to investigate the literature on knowledge translation, an increasing phenomenon which is particularly relevant in healthcare and medicine, where professionals and patients have different skills, competencies, and emotions, and thus find knowledge transfer difficult. The recent challenges that are questioning the way healthcare systems work have intensified the debate about the stakeholder's dialogue, and how different actors should be engaged and

cooperate in the healthcare scenario. Given the growing interests towards the managerial and best practices to be applied in healthcare institutions to overcome the current challenges and address the main issues, we decided to concentrate first on the Business and Management literature, to see what the current debate was about. Our limited sample, grabbed from the works listed on Scopus and labelled under the Business and Management fields, highlights an increasing academic interest towards the topic. New research avenues can be defined, as a more significant involvement of practitioners and private institutions, the investigation of some locations and areas, the idea of establishing a standard framework and a set of definitions, and the collection of practical tools and techniques to ensure an effective sharing, transfer, and creation of knowledge. Particular emphasis is placed on the potential relevance of future studies that seek to revisit the concept of knowledge translation from a practitioner's perspective, to better understand not only the drivers of knowledge translation but also the methods used and their transferability across different contexts and domains.

As every study, this paper has several limitations. First, we focused only on peer-reviewed work listed on Scopus and labelled in the Business and Management fields. While including all studies in the clinical field may bias our research aim (thousands of papers, chapters and books only mention the translation factor, but are about clinical cases or techniques), a more comprehensive result may be gathered while enlarging the sample to medical journals devoted to public policies or the wide field of Social Sciences. Despite in academic research, the peer-review process is considered as a synonym for quality in published works, several other relevant publications can be missing, like articles or books in languages different than English. This means that while our findings are informative for the relevant research and practice communities, these may not necessarily be generalisable to every area within the healthcare sector or to every context, and some initiatives, frameworks and models focused on knowledge translation may have been inadvertently omitted. Moreover, the validity of results can only be granted at the time of the analysis, also considering the growing academic interest towards the topic of knowledge translation in healthcare. Future contributions may indeed change the validity of the outcome. Readers should recognise that SLRs are not a panacea offering ultimate answers. Instead, such literature review methodologies have the ambition to detect research gaps and further opportunities for future studies.

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Knowledge Translation in Oncology. A Case Study

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Abstract: Knowledge translation (KT) is the ability to make knowledge accessible to different stakeholders by translating it into various contexts. Translating knowledge is particularly crucial in the healthcare sector, which is currently under significant pressure due to technological innovation, increasing demand of services by an ageing population, budget reductions, and new organisational challenges posed by the latest events like the COVID-19 pandemic. While the first definition of KT was focused on the translation of scientific research into clinical practice, other types of KT later emerged. In healthcare, while stakeholders have different skills and competencies (such as clinical scientists versus physicians or other healthcare professionals), others experience diverse emotional feelings (like the patients or their families). An effective KT allows the transfer, sharing, and creation of new knowledge, enhancing innovation and co-production dynamics. The paper employs a case study by analysing the Breast Unit of the C.R.O. National Cancer Institue of Aviano, Italy, one of the most acknowledged hospitals and research centres in Europe in the field of cancer surgery and treatments. The paper aims at studying the knowledge translation dynamics and tools by analysing the various relationships with the internal as well as the external stakeholders of the Breast Unit. Internally, knowledge translation is needed to merge the competencies of highly skilled multidisciplinary teams, which include surgeons and physicians with various specialities, researchers, psychologists, nurses and other healthcare professionals. Externally, knowledge is translated to meet the needs of patients, patients' associations, sponsors, citizens, and policymakers. Results highlight how different techniques and dynamics allow KT to happen within internal as well as external groups. Contributing to the knowledge management and knowledge translation theories, our findings open up to practical as well as research implications.

Keywords: Knowledge Translation, Healthcare, Stakeholders, Breast Cancer, Medicine

1. Introduction

Knowledge management is becoming a key issue in the private (Del Giudice and Maggioni, 2014; Shujahat *et al.*, 2019; Sousa, 2013) as well as in the public sector (Massaro, Dumay and Garlatti, 2015). Several studies have investigated the relevance of knowledge and its management in healthcare organisations (Jørgensen *et al.*, 2019; Miller, 2015; Sousa *et al.*, 2020). Knowledge management has also been considered as a means to cope with all the challenges that the healthcare field is facing, including the introduction of new technologies like augmented reality, big data analytics and artificial intelligence (Dal Mas, Piccolo and Ruzza, 2020; Dal Mas et al., 2020b), the need to provide services to an ageing population with chronic diseases (Bowser *et al.*, 2019; Miceli *et al.*, 2017), the budget cuts (Massaro, Dumay and Garlatti, 2015) and last, but not least, the need to redesign the system in a "new normal" after the COVID-19 pandemic at the beginning of 2020 (Cobianchi *et al.*, 2020b).

In this evolving scenario, the healthcare ecosystem is turning to a wide-open system (Secundo et al. 2019a) in which several different stakeholders need to engage in transferring, sharing, and creating new knowledge, enhancing innovation. While a multidisciplinary professional perspective is required in medicine and surgery (Gabel, Hilton and Nathanson, 1997; Olson, Tooman, and Alvarado, 2010; Qadan et al., 2020), there is an

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increasing call to engage the patients in the co-production of the healthcare products and services (Batalden et al., 2016; Dal Mas, et al., 2020a; Osborne and Strokosch, 2013). In such a perspective, the topic of knowledge translation is gaining increasing recognition both from academia as well as practice due to its decisive role in supporting innovation and the creation of new knowledge (Dal Mas, et al., 2020a; Simeone, Secundo and Schiuma, 2018). Knowledge translation is needed when the stakeholders involved have diverse characteristics in terms of skills, competencies, and expertise (Lemire, Souffez, and Laurendeau, 2013; Savory, 2006). Such features build relevant barriers that make it more difficult to transfer and share knowledge effectively, forcing institutions to find tools to enable the translation process.

Starting from this premise, the paper wants to investigate how knowledge is translated within a specific multidisciplinary unit of a public cancer centre located in Italy. Trying to understand the knowledge translation dynamics, the article addresses the following research question:

How is knowledge translated within a high-skilled knowledge institution in the healthcare sector?

The paper is organised as follows. The next section reports the trends in the literature regarding knowledge translation in medicine. The following section describes the methodology used, deepening the research context and data collection and analysis. Results are reported next, followed by the discussion. The conclusion section ends the paper.

2. Literature review

The terms “knowledge translation” recalls the concept of a foreign language which is literally translated into a different language in a divergent context (Secundo et al., 2019b). Savory (2006) stresses how the social nature of knowledge does not allow to talk about a “knowledge transfer” simply. A more comprehensive "translation" is necessary.

Knowledge translation in the healthcare sector is particularly interesting. Indeed, the healthcare ecosystem is based on the interactions of individuals and organisations into a complex adaptive environment (Jacquinet *et al.*, 2019). Productive relationships need to be managed as part of this complex system, and interactions among various actors allow to “produce valuable, new, and unpredictable capabilities that are not inherent in any of the parts acting alone” (Plsek and Wilson, 2001, p. 746). Healthcare ecosystems have been experiencing a shift from a centralised and sequential model of value creation to a more distributed and open model (Bowser et al., 2019; Chen et al., 2019; Cobianchi, 2020b; Gordon, Perlman, and Shukla, 2017; IBM, 2013; Siemens, 2018), where citizens and patients are co-creators of their own wellbeing (Batalden et al., 2016; Bessant, Moeslein, and Kunne, 2012; Biancuzzi et al., 2020b; Dal Mas et al., 2019a; Dal Mas, Paoloni, and Lombardi, 2019; Dal Mas and Paoloni, 2019, 2020). The healthcare ecosystems usually involve a vast number of parties (patients, physicians, clinical researchers, nurses, policymakers) that share their innovation processes to incorporate knowledge flows originated from or co-produced with external stakeholders (universities, research centres, industries, governmental agencies, NGOs, public institutions) (Ardito and Messeni Petruzzelli, 2017; Cobianchi, et al., 2020a; Dal Mas et al., 2018; Gassmann, Enkel, and Chesbrough, 2010; Huizingh, 2011; Renaudin et al., 2018).

In the healthcare scenario, one of the most renown definitions of knowledge translation is the one developed by the Canadian Institutes of Health Research[1], later adopted by the World Health Organization (Wallace, 2012). In this perspective, knowledge translation is defined as “the synthesis, exchange, and application of knowledge by relevant stakeholders to accelerate the benefits of global and local innovation in strengthening health systems and improving people’s health.”

The increasing interest towards the topic can be easily recognised through a search key named "knowledge AND translation AND healthcare OR medicine" in the title, abstract, or keywords on the scientific dataset Scopus (Massaro, Dumay, and Guthrie, 2016). Such search leads to more than 3,000 contributions, of which over 2,000 in the medical and clinical literature. The search key “knowledge translation” on PubMed leads to more than 85,000 results. The review of the literature highlights the presence of several different kinds of Knowledge Translation, according to the stakeholders involved and the aim of the transfer.

[1] http://www.cihr-irsc.gc.ca/e/29418.html

More in details, Knowledge Translation can be seen as:

- The translation of scientific research into clinical practice (Barcellini et al., 2019, 2020; Cobianchi et al., 2016; Hogan et al., 2012; Peloso et al., 2017; Turin et al., 2018; Vitolo et al., 2019a, 2019b), which aim is to transform knowledge into real-world outcomes, like new clinical protocols, surgical techniques, or drugs;
- The translation of the physician's knowledge to the patient (Kerosuo, 2010), in order to help the patient to understand the diagnosis, the possible treatments, the side effects, supporting decision-making;
- The translation of the patient's knowledge and needs to the physician (Angelos, 2020; Baigorri *et al.*, 2013), to understand the patient's situation and what may best suit him/her in terms of potential treatments;
- The translation of healthcare policies from the central government to specific units (Wallace, 2012), to allow knowledge to be translated into applicable policies, rules, and protocols;
- The translation of knowledge among organisations and professional groups (Cobianchi et al., 2020a; Straus et al., 2008), including the education of healthcare professionals (Garcia Vazquez *et al.*, 2020; Sokol and Shaughnessy, 2018), to enhance innovation and skills development;
- The translation of healthcare policies from public agencies to citizens (Giesbrecht *et al.*, 2009), to foster co-production of services, including good behaviours and best practices like in the case of prevention;
- The translation of clinical practices in healthcare policies (Ward *et al.*, 2012) to translate the latest medical innovation into proper regulations, laws, and protocols.

Most of the contributions in the clinical and medical fields highlight the way specific scientific research can be translated into clinical practice and then policies. Just a few studies emphasise how different professionals (scientists, physicians with various clinical backgrounds and specialities, other healthcare professionals, managers, engineers, physicists, patients ...) may translate knowledge to each other, fostering the sharing and creation of new knowledge. This opens up to a relevant research gap, given the interdisciplinary trends in medicine, surgery, and clinical education to face the abovementioned challenges of the healthcare sector in terms of digital technologies (Dal Mas et al., 2020b; Gordon, Perlman, and Shukla, 2017; Presch et al., 2020), budget reductions (Massaro, Dumay and Garlatti, 2015), and required skills (Dal Mas, Bagarotto, and Cobianchi, 2021; Fulop et al., 2019; Groenier, Pieters, and Miedema, 2017; Schutt et al., 2017).

3. Research method

To investigate our research question, we apply a qualitative case study approach (Yin, 2014). According to Massaro, Dumay and Bagnoli (2019, p. 275) "qualitative methods allow researchers to discover to reveal and understand relationships between variables even within complex processes, and to illustrate the influence of the social context." The literature considers the case study methodology applicable when a how or why question is asked on present issues where the researcher has no control (Yin, 2014). Moreover, case studies permit an insightful comprehension of a real-world case (Ridder *et al.*, 2014). To ensure transparency (Massaro, Dumay, and Bagnoli, 2019), the research context, the data collection and analysis process are explained in the next sections.

3.1 Research context

The case study is about the Breast Unit of the IRCCS ("Istituto di Ricovero e Cura a Carattere Scientifico" - Scientific Institute for Research, Hospitalization and Health Care) C.R.O. National Cancer Institute of Aviano, a public hospital devoted to oncological pathologies located in the north-east of Italy. The C.R.O. Institute of Aviano is one of the most recognised hospitals and research centres in Europe in the field of cancer surgery and treatments, awarded the status of "International Centre of Excellence" by the Italian Ministry of Health. In one year, the Institute performs over 2,300 surgeries, more than 20,000 radiotherapy treatments, over 3,600 positron emission tomographies performed and 453,000 outpatient services[2]. The Institute serves as an educational and training centre for the Universities of Milan, Trieste, Udine, and Modena Reggio Emilia.

[2] Source: the Institute's website http://www.cro.sanita.fvg.it/, last accessed March, 7th, 2020. Numbers refer to the fiscal year 2018.

Every year, nearly 1,7 million new breast cancer cases are diagnosed worldwide. Statistics claim how 1 out of 8 women has experienced breast cancer in her life, making it one of the most relevant diseases for women all over the world (Biancuzzi et al., 2019; 2020a). Breast Units are made up of multidisciplinary teams (oncology professionals, surgeons, psychologists, nurses, ...) fully devoted to the prevention, diagnosis, treatment, and rehabilitation of breast cancer patients (Kalager *et al.*, 2009; Plate *et al.*, 2018; Wilson *et al.*, 2013). Thanks to the multidisciplinary approach and knowledge (Kesson *et al.*, 2012; Saini *et al.*, 2012), Breast Units seem to have a higher success rate (Skinner *et al.*, 2003; Taylor *et al.*, 2010) in terms of survival and quality of care of their patients compared to non-specialised centres[3].

3.2 Data collection and analysis

Data collection and analysis were made involving several stakeholders from the Institute, including physicians and oncology experts, patients, and a public policy researcher involved in one of the Breast Unit's project, named "Oncology in Motion" (Biancuzzi et al., 2019; 2020b; Dal Mas et al., 2020a). More than 30 semi-structured interviews and 20 internal meetings about the abovementioned project were carried on in the period January 2019 - February 2020. Additional material like the Institute's website and social media channels and publications devoted to the general public was collected and analysed.

The following table highlights the data collection.

Table 1: Data collection

Methodology	Object
Semi-structured interviews	Two patients
	One manager from the administration department
	One researcher
	One project manager
	One policymaker
	One breast surgeon
	One medical doctor (oncology)
	One physiatrist
	One physiotherapist
	One fitness professional
	One nurse
	Two librarians
	One of NGO's members
Qualitative and Content Analysis	The Institute's official website
	Social network profiles (YouTube, LinkedIn, Twitter, Facebook)
	Six among brochures, leaflets, and booklets from the "Oncology in Motion" project

All the collected material has been double-checked with the scientific head and principal investigator of the project (LM). To safeguard construct validity and data triangulation (Yin, 2014), we collected data and information from various sources, besides interviews. One of the researchers is himself part of the Breast Unit team (LM); one (AB) is a radiation oncologist belonging to a different cancer institution; one (LC) is an academic and oncological surgeon; one more (HB) was involved in one specific Breast Unit project for more than one year; and two of them (FD and MM) are experts in the fields of knowledge management and public management. All the results were regularly discussed among the research team. To investigate the data, all the material was manually coded by one of the authors and then discussed within the research group.

4. Results

To analyse the knowledge translation flows, we first decided to map the various actors involved. In doing so, we divided the stakeholders into two different groups. One first group is represented by healthcare professionals with a common healthcare background. Most of such stakeholders work directly within the Institute. The second group included the external stakeholders, meaning actors who may not have a healthcare background, and who

[3] https://europadonna.it/progetti/breast-unit/le-breast-unit-in-italia/

may experience not only different skills and competencies but even contrasting feelings compared to the healthcare professionals.

4.1 Knowledge translation dynamics among the healthcare professionals group

The healthcare professionals group includes physicians and specialists (nurses, …) from the following departments:

- Breast Radiology
- Pathological anatomy
- Breast and Plastic Surgery
- Medical Oncology
- Radiotherapy
- Nuclear Medicine
- Oncological Psychology
- Experimental Oncology
- Genetics of Hereditary Tumors
- Biobank.

Moreover, the group includes members of the Institute's General Direction and one data manager. Given the clinical background, we decided to include in the group also the GP (General Practitioner) of the patients, despite not being part of the institute.

Our analysis shows how, despite the different skills and competencies, knowledge translation is pretty smooth among the group members, thanks to the common healthcare background. Several knowledge translation and knowledge management tools and techniques emerge.

First of all, the Institute invested in technological tools which allow to translate and share data and knowledge in a more accessible and standardised way. Electronic medical records (Ambra system) are used to store data and share information both internally and also with external professionals, like the GPs. One medical doctor involved in anaesthesia and pain medicine declared:

> *"Our systems need to comply with several regulations in terms of security and privacy of the patient's data. The use of electronic medical records is very expensive, still useful. We can access information anytime, and at the same time, we had to agree to a way to store and share information. In the beginning, we had some troubles in getting used to it; but now I cannot think about a better way to share patients' information with my colleagues."*

Multidisciplinary teams are established, and they meet on a regular basis to discuss the most challenging clinical cases. One surgeon stated:

> *"Working with a multidisciplinary perspective is one of the requirements of a Breast Unit. Every case is analysed as a unique one, and each of the professionals brings his or her own expertise and opinion. Open discussions and meetings are the central part of it. Not only we can assure the best cure to our patients, but we learn from each other's expertise and experience. While the past matters, there is always something new to learn."*

In-person discussions have been highlighted as an effective way to share knowledge, starting from clinical evidence and learn. The same surgeon later said:

> *"In-person discussions are our preferred way to share knowledge about the cases to be treated. We look at each other, and even non-verbal communication matters when we have doubts or concerns."*

Beside learning-by-doing, pieces of training are planned for all the staff, both online, as well as attending external courses, conferences, and seminars to learn about the new techniques and protocols and facilitate knowledge transfer. Journal publications are encouraged, as well as the use of literature synthesis and reviews according to the Cochrane library. Another medical doctor stated:

> *"We always need to keep up with what is going on in our scientific field. Not only we are pretty active in publishing, but we monitor the most relevant journals of our field. If some of us find some interesting news, we share the article with our colleagues, and we discuss results."*

The members of the Breast Unit are encouraged to travel and spend visiting periods at other research centres all over the world. External visitors are welcome as a way to improve knowledge. The Director declared:

> *"We always host scholars and clinicians from other centers all over the world, and I strongly encourage my staff to travel and spend time at other institutions. There is always something new to learn, not only in medical terms but also from a managerial and organisational perspective."*

The longevity of the members, together with a low turnover, are considered relevant to retain and share knowledge, and also mentor students or residents from universities. The quality is assessed not only internally, but also thanks to the various certifications and accreditations of the Institute. The Director underlined:

> *"Quality assessment is not only relevant to measure our standards, but it encourages us to manage data in a certain way. Enhancing knowledge transfer and sharing is a key element in all our assessments."*

4.2 Knowledge translation dynamics among the "external" group

The "external" stakeholders group includes various actors who need to translate knowledge from and to the Breast Unit. The main parties of such group include:

- The patients and their families
- The citizens
- Associations which actively provide services for the Institute
- No-profit associations and NGOs
- Policymakers belonging to the central and local government and various towns and cities
- Private companies (mainly belonging to the pharmaceutical sector) which sponsor clinical trials.

As said, the lack of healthcare and clinical background, as well as the intense feelings and emotions (especially those of patients and their family members) make the knowledge translation process more challenging. Several tools and techniques are used by the Breast Unit members to translate knowledge with such stakeholders effectively

Clinical data and information are often difficult to understand. Design elements, meaning the use of sketches, graphs, cartoons, videos, are used to translate knowledge communicating to a general audience of patients but also citizens seeking for information, considering that prevention is one of the most relevant tasks of the Breast Unit. The Project Manager of "Oncology in Motion," a project devoted to the recovery of women who underwent breast cancer surgery, declared:

> *"The Oncology in Motion initiative required the engagement of several stakeholders who differed from skills, aims, and feelings. The use of design elements and artefacts like sketches, graphs, and pictures helped the group a lot in staying focused and cooperate in the definition of the idea, in its fine-tuning, and even in the communication to external parties."*

Communication materials and documents such as brochures and leaflets were designed even co-producing the content with patients, citizens, and no-profit associations, in order to ensure the maximum results. The same Project Manager underlined:

> "We put a lot of efforts in designing the project brochure. The whole project team made up of professionals and the population, including patients and citizens, wanted it to be perfect for the women who had to undergo the cure. The cooperation within the group and the design were central elements to ensure that all meaningful information and details were included, from everyday tips to easy fitness exercises to enhance the rehabilitation."

Online tools and social media channels are used to share contents with the general audience. Specific seminars, roundtables, discussions, Q&A sessions, and information tables at local events are organised to get in touch with

citizens, associations, private companies belonging to the healthcare industry and policymakers. A member of one of the many NGOs which regularly cooperate with the Institute declared:

> *"Today, the use of social media networks is a must, especially when it comes to citizens. All the initiatives are advertised and promoted via Facebook and other channels, also creating nice posts and events to remind people about the meetings and initiatives, and tagging eventual hosts or partners."*

One medical doctor stated:

> *"The institute's Youtube channel features many of our interviews and speeches.Talking in front of a camera sometimes embarrasses me, but I do understand that this is a means to communicate with our patients and with people in general. Prevention is one of the central aims of our breast unit, and we must be effective when transferring knowledge to the general public about what should be done in order to monitor the health status. Showing our faces helps in creating one first relationship with our patients. Of course, we try to use a simple language while doing this. Our psychologists help us a lot in polishing our communication techniques."*

Testimonials like athletes and celebrities are involved in disseminating ideas and information and in raising funds. The Breast Unit members are trained by the Institute's psychologists to use a simple language, metaphors, interpersonal skills and get engaged with the patients and their families during the cure and the rehabilitation path. The Director highlighted:

> *"One of our main goals is to be able to communicate with our patients in an effective way. We undergo training with our psychologists to be prepared to discuss with our patients – who may be young, old, educated, or not. The fact is that sometimes is not about communicating a diagnosis, but the patient needs to decide among some possible alternatives. Our duty is to make sure that the patient understands all the pros and cons and makes the best decision for her. It is not only about talking. It is also about listening. Narrative medicine is a means to make sure that we speak less and listen more, trying to understand the patients' needs and concerns. As a team, we are trying to work a lot about this."*

During the clinical journey, routines and checklists are used to ensure that the knowledge is effectively translated to the patients, who contribute to the co-production of the service. One nurse said:

> *"Our leaflets, brochures, and publications devoted to patients and the general public are designed in a clear way, or at least we try to! Marking our patients understand what they can or cannot do or what they should do or avoid is a starting point for them to heal. Therefore, translating knowledge to them [the patients] is central to help them in their healthcare journey."*

5. Discussion

Investigating the knowledge flows at the Breast Unit of the National Cancer Institute of Aviano, we noticed the presence of different stakeholders groups (Biancuzzi, et al., 2020a; Bowser et al., 2019; Secundo et al., 2019a).

One first group was made up of healthcare professionals, who, thanks to both tacit as well as explicit knowledge management tools, could translate knowledge more easily (Sousa *et al.*, 2020). Dynamics within this group suggest the relevance of technological tools and routine practices (Baigorri *et al.*, 2013; Friberger and Falkman, 2013) as knowledge enablers. Pieces of training and learning about new protocols (Aruni, Amit, and Dasgupta, 2018; Cobianchi et al., 2016; Dal Mas et al. 2019b; Vitolo et al., 2019b), publishing (McAneney *et al.*, 2010), mobility, visiting periods at other institutes or hospitals (Conway, Dowling, and Devane, 2019) and meetings with colleagues and professionals from other centres (Olson, Tooman, and Alvarado, 2010) contribute to the accumulation and creation of new clinical knowledge.

The second group includes those stakeholders without a specific healthcare background, who often experience intense feelings engaging with the Breast Unit. The strategies employed by the Breast Unit members to translate knowledge to such stakeholders are for sure different than the ones used within the clinical team. Design (Dal Mas et al. 2020a; Simeone, Secundo and Schiuma, 2017, 2018), brochures and guides, social media channels and online tools (Dal Mas, 2019; Massaro *et al.*, 2018; Presch *et al.*, 2020), specific Q&A sessions (Sokol and

Shaughnessy, 2018), the use of a simple language (Wallace, 2012) and kindness (Tribble *et al.*, 2008) represent tools which are capable of engaging the patients and the community (associations, private companies, sponsors, members of the local government and cities). Translating knowledge to engage external non-professional stakeholders leads to co-production as a way to co-create new knowledge and services (Batalden et al., 2016; Biancuzzi et al., 2020b). Knowledge translation appears strategic in all the aims of the Breast Unit: engaging with the community to enhance prevention, to better treat the disease, and to improve rehabilitation, leading to the wellbeing of the patients and the population.

Thus, in answering our research question "*How is knowledge translated within a high-skilled knowledge institution in the healthcare sector?*" we may highlight the differences between professional and non-professional stakeholders groups in leading the knowledge translation. While within professional groups, like the one of the Breast Unit, knowledge flows are easier to manage, better with the help of technical tools and routines, non-professional stakeholders require the use of more creative techniques like design, testimonials, social media and interpersonal skills. The team dynamics highlight the fact that permanent teams differ from temporary groups. These dynamics can be described not only starting from the fact that competencies and skills vary (the professionals belonging to the Breast Unit do have a common clinical/healthcare background and a clear working mission), but also the fact that permanent groups, which work in a completely different way than temporary teams (Massaro et al. 2019), build their own language, routines, processes, which make it easier to translate and share knowledge in an effective way. People who engage with the Breast Unit only when needed do not have enough time to do so. Therefore, more creative ways such as design and social media help to manage the skills and emotional barriers. In such a perspective, the relevance of non-technical skills emerge (Dal Mas, Bagarotto, and Cobianchi, 2021; Lepeley, 2021; Lepeley and Albornoz, 2012; Yule and Smink, 2020).

6. Conclusions

In concluding our work, we would like to recall the premise that inspired it. Knowledge management is a central topic for modern healthcare organisations. While healthcare institutions are more open to the engagement of several different parties, knowledge translation issues emerge. There is a need to understand which dynamics lead to the effective transfer, sharing, and creation of new knowledge. Multidisciplinary groups and teams are more and more frequent in the healthcare scenario, like in the case of Breast Units. The Aviano experience highlighted how the effectiveness in translating knowledge both among internal as well as external stakeholders might help the healthcare organisation in reaching its goals, even by involving the non-professional actors and users in co-production processes, allowing the patients to co-create their own value. In this perspective, the leading institution should ensure that appropriate knowledge translation tools and mechanisms are put in place to allow the various groups to soften up their differences and foster the sharing and creation of new knowledge.

As a polar case (Yin, 2014), the National Cancer Institute of Aviano experience may be useful to other healthcare institutions experiencing the same issues, in defining practical tools to enhance the translation of knowledge.

Like all research works, ours has some limitations. The specific context (a multidisciplinary Breast unit in a vibrant research and clinical institute located in Italy) may bias the results. Although we tried to ensure data validity and reliability, some results come from the researchers' evaluation and perspective.

Further research implications may include the detailed investigation of some of the knowledge translation techniques described in the case or comparative studies with other Breast Units or centres located in different areas.

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Detrivialization as a Strategy to Challenge Organizational Groupthink

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Abstract: This paper aims to contribute to the literature on knowledge construction and knowledge sharing within the field of organizational communication. The research underlines the importance of exploring human learning contextually, descriptively, interpretively, and inductively. Through a participant-observer methodological approach, the study contributes to the literature by introducing detrivialization as a strategy to explore 'participants' rhetoric related to their organizational procedures. The paper describes a case study that took place for 18 months in a cancer research lab in Belgium, where employees seemed unable to question several taken-for-granted practices. The present research primarily reveals the consequences of trivialization, when the rationale of essential organizational practices go unnoticed until observer-participant challenges the status quo. Also, the study highlights the outcomes of the detrivialization approach, which triggers unprecedented knowledge. Finally, the paper introduces the (de)trivialization dynamic model, which can depict the consequences of opening black-boxes in organizational contexts. This research is a new approach in organizational ethnomethodology, revisiting 'Garfinkel's (1967) breaching experiment to describe science in action. The suggested model offers a methodological approach for exploring trivialized organizational dynamics and challenging groupthink. Detrivialization is an opposite approach to trivialization, to offer a new debate topic to scholars aiming to conduct ethnographic research and discourse analysis in organizational communication.

Keywords: Detrivialization, knowledge construction, knowledge sharing, groupthink, discourse analysis, organizational culture, organizational communication.

1. Introduction

How do we know what we know? This fundamental question functions as the basis for knowledge construction. The present paper calls attention to *trivialization practices* within organizations as a strategy to examine how employees make meaning and share collective knowledge in organizational contexts. In organizations, as in any social setting, trivialization practices go unnoticed to the extent that employees follow them unquestionably and fall into groupthink (Carlson, 2016; Kuhn, 2014; Hällgren, 2010; Mpeera Ntayi et al., 2010; Garfinkel, 2002; Latour 2005; Simon et al., 1995; Kroon et al., 1991; Whyte, 1989; Latour, 1987; Janis, 1982; Latour & Woolgar, 1979; Janis 1971; and Festinger, 1962). In the same pursuit, the present research inductively identified a case where employees trivialize pieces of information to the extent that groupthink occurs over issues that they paradoxically consider to be of great importance. What outcomes could such practices generate in the context of knowledge construction? What happens if people identify and question trivialized organizational practices?

Kuhn (2014) argues that the study of knowledge construction from an organizational communication perspective is gaining an increasing interest. This research is part of a global academic pursuit regarding "*what is learning or what makes knowing?"* The authors suggest that studying trivialization practices as such can be an effective strategy to understand the unexplored aspects of organizational knowledge and to avoid groupthink. By *triviality, we* mean the "lack of seriousness or importance; insignificance," and by trivial, we refer to something "of little value or importance" (Trvial, Oxford dictionaries, 2018). To *trivialize* means to "make (something) seem less important, significant, or complex than it is.

Knowledge creation and sharing are discussed in the literature. The organizational behavior factors of organizational culture, job performance, and knowledge sharing lead to job satisfaction. Kucharska and Bedford (2019) argue that to optimize company performance and increase job satisfaction, organizations should enhance knowledge sharing. Evans et al. (2019) suggest a two-way method to examine knowledge sharing. The authors argue that research should first explore the usefulness of shared knowledge, and second, the participants' willingness to communicate that knowledge. Through surveying legal professionals at a large Canadian firm, the latter study revealed that organizational ties, competence, integrity, and trust have a substantial impact on

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sharing tacit knowledge. Kyakulumbye et al. (2019) explain that social interactions construct and share tacit knowledge in organizational settings.

People say that *the devil lies in the details* when they explain the importance of accurate information in knowledge construction. Sometimes employees fail to notice the rationale of their daily work routines, considering some practices and pieces of information as trivial. Furthermore, when this situation occurs in scientific research labs, it may have more serious consequences. Research findings may unnoticeably and avoidably be skewed. Therefore, the authors adopt a participant-observer ethnographic approach to explore the views and rhetorics of researchers about trivialization practices in a cancer research lab. Following an ethnographic approach, the others examined the inextricable relationship between human communication and knowledge construction through a case study of a cancer research lab in Belgium.

The authors use a pertinent case study, a learning organization and focus on some practices of *trivialization*, aiming at understanding their underlying dynamic. They studied the organizational dynamics caused by *trivialization practices* as a strategic entry point to explore aspects of the *learning* or *collective knowledge construction.* Through a case study, the authors identify and explore some trivialization practices that emerge in interactions as key and unique moments in the knowledge construction dynamic. We suppose that if we capture and study those moments where people (scientists in the case of the present research) trivialize matters, we can gain insights into what they collectively assume, how they make choices and drop others, and how they prioritize matters and play down others, etc. More particularly, the research pays attention to whether our scientists trivialize matters systematically or sporadically, noticeably or inadvertently, and most importantly: can they rationalize their choices? We assume that such a pursuit could constitute a new strategy to observe knowledge construction in situ (scientists in a research lab). Therefore, this paper has two objectives. The first objective is to examine how *trivialization* occurs in organizational communication, to focus on the outcomes within the broader learning dynamic. The second objective is to suggest an organizational communication model of reverse *trivialization.* For this reason*,* we introduce the term detrivialization as a neologism to refer to the reversal of trivialization*.* We are using *detrivialization* as a strategy to explore what our scientists have 'silently' taken-for-granted.

The next section builds on the existing literature to include past research findings reporting how people in organizations can distort or compromise scientific knowledge. This paper aims to inquire about the usefulness of studying *trivialization* to explore knowledge construction in organizational communication.

2. Literature review

Groupthink is a well-established concept in social psychology and communication. Groupthink refers to an illusion of agreement and to an excess of group cohesiveness, which causes limitations to knowledge building (Beebe and Masterson, 2014). Hallgren (2010, p.97) writes that "groupthink behavior is associated with people retaining the status quo by minimizing their conflicts without critical assessment, analysis, and evaluation." A group experiences groupthink when it meets three conditions: overconfidence, closed-mindedness, and pressure towards conformity (Manz and Neck, 1997).

Whyte (1952) was the first scholar to use the term groupthink, but Janis (1971) researched within the theoretical framework of social psychology. Janis (1982) argues that groupthink is a concurrence-seeking tendency that relates to cohesiveness, structure, and context. Janis (1971, p. 43) establishes the relationship between groupthink and trivialization "in the spirit of Parkinson's law […] the more amiability and esprit de corps there is among the members of a policy-making ingroup, the greater the danger that independent critical thinking will be replaced by groupthink, which is likely to result in irrational and dehumanizing actions." *Parkinson's Law of Triviality* (Parkinson, 1958) also addresses the connection between groupthink and ambiguity in knowledge construction.

Although the term groupthink was primarily discussed by Whyte (1952), the literature remains limited to understand how groupthink affects knowledge sharing (Carlson, 2016). Koerber and Neck (2003) revisited Whyte's groupthink framework to analyze several resignation decisions in the Major League Umpires Association. The latter authors underline the relationship between groupthink and defective decision making. Also, Ben-Hur et al. (2012) suggest that the organizational context affects knowledge sharing and decision making. On the same wavelength, Kroon et al. (1991) argue that the realization and reduction of groupthink in

organizations, lower collective avoidance, and increase individual accountability. Mpeera Ntayi et al. (2010) and Eaton (2001) confirm the strong relationship between social cohesion, groupthink, concurrence-seeking, and ethical attitudes among employees as significant factors of ethical behavior. Studies on groupthink show that group over-cohesiveness causes defective decision making (Sai On Ko, 2005), while over-reliance on collective organizational trust can impact negatively on performance (Erdem, 2003).

In the present case study, once we identify instances of trivializations in the cancer research lab, we question them. We are not content with "clear cut" answers that are usually solicited by structured questionnaires. Instead, we explore these trivializations by opening detailed discussions with the lab members. We also aim to compare and contrast the different responses and accounts, because if the lab members happen to be avoiding controversies, we may not be able to understand the complexity of the trivialized issue.

As a psychological phenomenon, scholars who ask open-ended questions can recognize groupthink within real meeting dialogues over trivialized issues (Eisenberg et al. 2010). This research suggests detrivialization as a method to explore existing knowledge. Eisenberg et al. (2010, p.46) distinguish among four types of dialogues: *the mindful communication dialogue*, *the equitable transaction dialogue*, *the empathic dialogue*, and *the real meeting dialogue*. The latter authors emphasize the need for the real-meeting dialogue in learning because it is "not merely for the purpose of exchanging ideas or information in order to learn, it is engaged in for the purpose of revising how the parties involved actually understand something."

Although the empathetic dialogue can be essential in achieving cohesion, harmony, and understanding between group members within organizations, the real meeting dialogue "involves far more than simply getting someone's "take" on a situation for the sake of information; it involves being open to changing an opinion as the result of soliciting the perspective of another" (Eisenberg et al. 2010, p.46). To avoid empathizing with others at the expense of being authentic (e.g., being able to say what we think and not what others want to hear), real meeting dialogues lead to new and better ways of organizational practices. Daring to rethink what has otherwise been trivialized or taken for granted is that crucial moment where we shift from an empathetic to a real meeting dialogue (Garfinkel, 2002).

Trivialization is another socio-psychological phenomenon that this research examines. Within the framework of the *Sociology of Scientific Knowledge* (SSK), scholars have emphasized the importance of focusing on triviality and trivialization in scientific contexts (Kuhn, 2014; Latour 2005; Latour & Woolgar, 1979). Through observation of a biology lab, Latour & Woolgar (1979, p. 274) reported that what interested them as sociologists was described by the biologists (their own participants) to be "unsurprising if not trivial" and that such "reaction was a nice confirmation of the accuracy of our [their] observations."

Moreover, Latour and Woolgar (1979, p. 154) offer examples of how "facts can be created and destroyed during brief conversational exchanges." The latter authors argue that group members face difficulty contradicting one another to avoid controversies at the expense of accuracy. Latour & Woolgar (1979, p. 243) write "the standing of one scientist might be such that when he defines a problem as important, no one feels able to object that it is a trivial question."

Building on the fundamental research of Latour & Woolgar (1979), the current paper's authors aimed at following scientists in their habitat to explore their knowledge construction on the go; i.e., before packaging. Latour (2005) argues on the need to open "Pandora's black box,"; i.e., urging scientists to engage in thoughts and discussions about how otherwise taken-for-granted things actually work inside (example machines) and not just to assume that they are working correctly. Latour (2005) stresses the need to follow scientists during their construction of knowledge (in situ), not when they present their 'nicely packaged' findings.

After observing people at work, "reality was the consequence of the settlement of a dispute rather than its cause" (Latour & Woolgar, 1979, p. 236). The latter authors mention that the lab members avoided disagreements at the expense of scientific accuracy, regardless of the consequences of compromising knowledge building. Based on these findings, Latour and Woolgar (1979) stress the importance of distinguishing between what is scientific and what is not in the scientists' discourse.

At the individual level, socio-psychological studies have described in different ways the psychological hassle that an individual can experience. Simon et al. (1995) conducted four separate studies and concluded that their

participants use trivialization (reduction) when they face the psychological pressure of cognitive dissonance (being seen as contradictory). Rather than changing of opinion or admitting the contradiction, participants played down the importance of disagreement.

Other studies illustrate that people do not want to be seen as contradictory or inconsistent because they suffer from mental stress (Festinger, 1962). In the present case study, we examine how individuals in a cancer research lab would argue when contradictions would be pointed out. Also, the authors examined to what extent participants were compromising knowledge to avoid talking inconsistently. Finally, building on several scholars' research (Kuhn, 2014; Garfinkel, 2002; Whyte, 1989; Janis, 1982; Latour and Woolgar, 1979), the present paper argues that observing how people interact at work helps at understanding how knowledge is being constructed. This paper's authors argue that: a) *trivialization* can potentially hinder knowledge building and that b) studying detrivialization can be a good strategy to gain insights on knowing.

After defining *triviality* and building on Latour's work (1979, 1987, and 2005), the paper explores how *trivialization* would function within a cancer research lab. Using Callon's (1986) translation theory model, the authors enquire how to trace back knowledge building over long-established trivialized ideas and how to distinguish between the scientific and non-scientific constructs. The next section explains the methodology that this research follows.

3. Methodology

Discursive psychology forms the theoretical and methodological framework of this paper. The research hinges on Potter's and Wetherell's (1987) discursive psychology assumptions. The latter authors argue that knowledge is a discourse activity, and studying how people construct knowledge can be achieved through the analysis of the discourse practices in all their forms. We decided to adopt discursive psychology as our framework for two reasons:

1. discursive psychology is a discourse analysis method oriented into socio-psychological factors and is therefore well-positioned to study knowledge construction issues (i.e., trivialization, individual and group practices, learning organizations) (Potter and Wetherell, 1987);
2. discursive psychology is effective in analyzing scientific discourse since our data is scientific (cancer research data, collected through observation and interviews). Because "*discourse*" applies in a variety of interpretations across disciplines such as linguistics, psychology, anthropology, literary studies, philosophy, and communication studies, in the present study we use the term to mean "all forms of spoken interaction, formal and informal, and written texts of all kinds" (Potter and Wetherell, 1987, p. 8).

The present research aims at exploring the trivialization practices in a cancer research lab in Belgium. The study seeks to understand the covert and overt dimensions of sharing trivialized scientific information and how such an organizational communication dynamic relates to knowledge construction. This paper's authors adopted a participant-observer methodological approach to understand how employees were sharing scientific knowledge and identify which information seemed to be trivialized to their work routines.

The study follows a similar methodological approach, as developed by Latour and Woolgar (1979), who describe their research as "microprocessing of facts." After conducting a longitudinal observation within a biology lab in the US, Latour and Woolgar (1979) provided details on how people constructed scientific facts. The latter authors scrutinized moments where the biology lab scientists took decisions and made choices in a somewhat unexpected way. Many times, scientific facts were "born" (when proved by scientists) and "destroyed" (when rejected as wrong). The same study showed that sometimes an odd set of accidental circumstances dictated the scientists' decisions, unnoticeably. Hence, specific scientific facts, no matter how well-established they could be, were seen by the lab scientists as [as]sociologically (rather than logically) determined (Latour and Woolgar, 1979).

This study aims at exploring three main questions: a) how trivialization practices construct organizational knowledge; b) how organizational knowledge emerges through detrivialization approaches, and c) how ethnomethodology and discourse analysis could be useful in understanding aspects of knowledge building. The study suggests the exploration of the (de)trivialization dynamic in terms of three research levels:

(inter)organizational, individual, and group following the chronological sequencing that we undertook: observation, individual, and then group interviewing.

The research presupposes that trivialization is a practice that exists in cancer research labs, as in any other social context (Eisenberg et al. 2010; Whyte, 1989; Janis, 1982; Latour and Woolgar, 1979). From a broader philosophical perspective, our research addresses Feyerabend's (1978) concern regarding the dogmatic and sectarian practices of modern sciences. One of the paper's authors conducted the field research as participant-observer at a cancer research lab in Brussels, Belgium. The observation period lasted 18 months with sporadic absences. Through this period, the field researcher was able to access the lab daily. The field researcher received permission to access any area in the lab and speak to all stakeholders.

After gathering several contradictions and inconsistencies for this case, during the observation stage, we conducted semi-structured tape-recorded individual interviews with the ten lab members, which we analyzed synchronically. Approximately six months later, we conducted collective tape-recorded interviews questioning the same issue with the lab members, which we analyzed diachronically. We used Potter's and Wetherell's (1987) methodological tools to analyze our findings.

Using the data that we collected from the individual interviews, we identified several variations of accounts across persons and some inconsistencies made by the same person during the same interview. We detailed where 'scientific knowledge' is interwoven with ungrounded knowledge: 'common sense' and 'value judgments.' We also identified how individuals' accounts and positions regarding the issues (previously trivialized) were developing on the move about our questions or to how the ongoing discussions were progressing. This method helped us identify discourse strategies used to avoid dissonance. Hence the detrivialization prompted by our research triggered new accounts and positions, which have research implications.

The diachronic and collective interviews helped us identify the same variations and controversies as examined synchronically and individually. The intermingling between 'scientifically grounded knowledge' and the 'common sense' and 'value judgments' that emerged during the synchronic interviews persisted in the diachronic conversations, and the ungrounded trivialization practices in discourse grew stronger. Hence, depending on our questions, the participants oscillated recursively and restlessly between trivializing and detrivializing positions. We outlined dissonance avoidance (Festinger, 1962) strategies used by the participants to bypass controversies without settling them.

Following the same steps of fieldwork research, as Garfinkel (1967) explained in his *breaching experiment*, the study's field researcher adhered to the lab's safety rules and explained to participants the central role that anonymity and confidentiality play in social sciences research. The field researcher requested for participant's formal consent to participate in the study by assuring them that anonymity is guaranteed. Therefore, all names mentioned in this paper are not real to ensure that no one can trace back and link the people with the data they provide.

The study's participants were ten lab members: the principal investigator, four postdoctoral researchers, two doctoral researchers, two technicians, and one intern. Except for the intern, all the members have considerable experience in cancer research labs (from 7 to 25 years). Two of them are Belgians; the others are from different nationalities: Dutch, French, Spanish. Except for one technician, all of them have international experience either in Paris or in the USA. The lab director and founder pursued his graduate and postgraduate studies at universities in the USA.

To support the lab staff's scientific competence, we visited the lab's website to read people's bios. The director is involved in the publication of 217 research articles; 30 of them also include the names of the postdoctoral researchers. The same website lists 17 reviews, dated from 2002 to 2017, each of them is of multiple authors (usually 3, but a couple of them have 5 and 6 authors). Finally, the lab staff has published nine scientific books between 1995 and 2012. The next section introduces the case study and explains in chronological order some critical discussions between the field researcher and the participants that lead to knowledge creation.

3.1 Case Study: The incubator's CO_2 level for cell culture

The case study below is a narrative written in the first person to highlight the field 'researcher's first-hand experience with ethnographic research. Hence, the case study aims to bring the reader closer to the lab's

experience and demonstrate the levels of familiarity and openness between the field researcher and the lab scientists.

During my first weeks in the lab, I walked into the culture room and found Sophie, Stephan, and Marie (all names are given by the authors to maintain anonymity and assure confidentiality). Sophie is a medical doctor and had worked as a physician in hospitals for six years before joining the lab. When I faced an incubator, I noticed that it displayed the following two figures: 5% CO_2 and 37°C. I assumed that 37°C is the appropriate temperature to maintain the cells as in a healthy human body. But why is 5% the appropriate level for CO_2? I was trying to see how the gas tank was linked to the incubator, assuming that it was there to automatically feed it with the quantity of CO_2 each time the pressure within the incubator drops.

Sophie, who had been willing to explain things to me, looked at me and said in French: "that's for CO_2". My follow up question was: "Why do these cells in the incubator need CO_2?". The response was, "as in our body." I said, "but why 5%?". When I said that, she looked away and I felt that the mood changed in the room, but could not tell what was wrong. I moved next to Stephan, who listened to the discussion and was usually willing to talk. Stephan's response also demonstrated some ignorance in providing us with an answer, as it seemed to him a trivialized matter. I decided not to insist on asking to follow up questions to avoid disturbing anyone.

A few minutes later, Sophie asked Stephan, who said: "I have no clue why 5%". Then, I deduced that the silence in the room has something to do with my question, and possibly they were trying to find an answer to the question. Then, Sophie looked at me and said in French, "it's shameful." I said, "what is shameful?"; she said that they didn't know why the incubator is regulated at 5%. I told her, "but no one knows everything." Sophie said, "yes, but this is important." I later realized why Sophie was upset about the fact that she does not know the answer. Being a physician, she probably thought that she should have known how much CO_2 the human body needs.

This CO_2 indicator proved to be a trivialized issue that lab scientists were observing unquestionably. I asked several people in the lab about the CO_2 indicator, including the three post-doctoral researchers, two technicians in the culture room, and an intern. The responses to my questions were like the following: "I don't know," "I have no clue," "ah, that's a good question, but I don't have an answer, right now," but whenever I kept the discussion going the lab scientists responded in a rather similar fashion. Some participants aimed to justify an answer, but they lacked scientific proof. "I don't know, but it is important for the equilibrium of the cells," "it's to maintain the cells in good condition," 'it's important for the phenotype." All participants seemed to provide me with confusing and sometimes off-topic explanations. On the first day where this issue was identified, none of the lab members was able to explain why the incubator is regulated at 5%.

After searching online for relevant answers to the question about the CO_2 indicator, I found that no matter what the exact answer was, the CO_2 was said to be used in the incubators to maintain the acidity or the pH level in the medium, where the cells are cultivated. The next day, I discussed with everyone I came across, and many of them provided me with the same answer that I found online. I started to hear things such as, "yeah, that's normal because, without CO_2, the pH level would drop," "yeah, it's related to the acidity of the medium." Knowing the source of their answers, I pushed for further discussions by asking, "ok, but why 5% in particular?" and "who decided that?". At this level, all of them said in a way or another that it was tested in the past and that was part of the basics that research at this level should not rebut.

Discussions started to become interesting for both sides. Certain lab scientists showed great interest in discussing with me. A trivialized matter that was taken for granted had become a topic of general interest and discussion. People seemed to agree that the matter was " related to the ph level," my question evolved into why 5% in particular and not more or less? The main question evolved into several other sub-questions, such as, "does the human body also have 5% of CO_2?" and "are there other side effects that could happen to the cells if the 5% is not the best choice?"

After a couple of months of discussions over similar issues of trivialized organizational procedures, the general feeling was that many matters were taken for granted without any of the experts in the lab trying to challenge the status quo. Lab scientists were relying on each others' knowledge. It was a unique case, where I could experience and observe discussions over issues that were initially said to be either trivialized or unknown and to explore how organizational knowledge could be constructed in discourse. Although we discussed several

matters during my field observation, the authors of this paper find the case of the incubator's CO_2 level for cell culture to be unique and representative of how organizational knowledge could be constructed. Therefore, we decided to conduct tape-recorded follow-up interviews with the lab scientists over the issue of the CO_2 level in the incubator.

We designed a semi-structured interview, which we conducted with each participant individually. Then we organized a collective interview with a few participants six months later to cross check our findings. The individual interviews included eight questions each, which allowed us to start the conversations. The eight questions are listed below:

1. Why is the incubator regulated at the level of 5% CO_2?
2. Have you heard this question before?
3. Do you think that this question has been trivialized or neglected?
4. Do other biology labs in Belgium and elsewhere also regulate their incubators at 5% CO_2?
5. Do you think that this question is important for your research?
6. Is 5% of CO_2 the same condition in the human body?
7. How true this is: ""incubators are regulated at 5% CO_2 because that is how the desired pH level can be maintained""?
8. What other negative consequences can happen to the cells, due to this 5% level?

Depending on the participant's accounts in each question, we asked further questions. The different interview questions were designed to invite the participants to account for the following central issue: *Does the 5% level of CO_2 have negative consequences on research?* The collective interview, which also included the same eight questions as the first interviews, was less structured because the participants anticipated many questions. Nonetheless, we made sure that we went through all of them to get as much data as possible to analyze.

4. Findings

Through the analysis of the case study and the collected data, this study identifies three major findings. The first finding is that the lab participants had never discussed why they were using 5% of CO_2 in their daily cell culture operations. The field researcher's questions on a trivialized matter triggered internal discussions and constructed organizational knowledge. Through field observation and question #2 of the individual interviews: "*have you heard this question before?"* the participants realized that they were experiencing groupthink by not challenging a piece of scientific information.

The lab scientists were surprised by our questions and were initially not able to provide answers (saying typically: "I don't know," "it's a shame that we don't have an answer"). At the same time, the participants said that the use of this level is extremely important and that they should not change it by any means. Later in discussions (during observation), the participants figured out more or less the same answer to our question: *that the 5% is important for the pH regulation*. With further detailed discussions, we found that the different lab members' responses were quite variant and sometimes contradictory. Likewise, accounts of the same person were sometimes inconsistent.

During the individual interviews, new ideas emerged out of the detailed discussions; and participants shifted positions several times. All participants said that the 5% level is a standard (or a norm) that is accepted worldwide, but all of them have accounted for the negative consequences of this standardization. They said that it might potentially skew any of their experiments, which they do on cells that do not require 5% of CO_2. They mentioned the following skews: "phenotype change," "shifting from in vivo model," and "blinding."

The second finding is that the use of the 5% level was *a seen but unnoticed practice* (Garfinkel, 2002) and that our question, which aligns with Garfinkel 1967's strategy of breaching experiment, triggered unprecedented discussions. Hence, more and more detrivializing accounts emerged and gained ground. Additionally, we found that one postdoctoral researcher had -to the surprise of her colleagues- used 10% in one of her previous labs, although all the participants said that any level other than 5% would not be acceptable; because it would change the cells' pH, and therefore skew their experiments. The postdoctoral researcher said that she does not know why this lab is using 5%, although she said that she already knows that this level is a worldwide standard.

The third finding is that the origin of the standard of 5% was not known. Instead, the lab director concluded during the interview that it was initially *dictated commercially* and did not emanate from research. The lab director also said that the providers who were first able to produce a medium with a pH of 7.4 (which was solicited by research) dictated the level of 5% of CO_2. Hence, the 5% level is successful in reaching a pH of 7.4, but its drawbacks for other considerations are at least according to our participants not known. They have never been discussed within the scope of cancer researchers.

In line with Latour and Woolgar (1979), several non-scientific accounts were used to justify scientific positions: a) defending the need to standardize the level of 5%, even after saying that the level can skew research and that it needs to be revised depending on the requirements of the cell; b) justifying the 5% level by the need to replicate the same research by another lab, even after we pointed out many times that labs that are interested in replicating their experiment can do so by following the research protocol with whatever level it mentions and not necessarily 5%.

Finally, some participants realized after openly discussing the matter that they are using the 5% level even for cells that do not need a pH of 7.4, but rather 6.5. Some participants said that a 5% level was appropriate for any desired pH level, whereas others assured that the 5% is specifically for the cells that need a pH of 7.4. Because the lab uses the same incubators (regulated at 5% by default) for all types of cells (those that need a pH of 7.4, 6.5, etc.), the participants who said that 5% is only suitable for a pH 7.4, clarified that they add buffers to cells that require 6.5 pH. When they referred to buffers, all participants added or implied that the buffers' negative consequences are not trivial and that they would need to reconsider how to reach the desired pH level, not through the 5% level of CO_2. The next section discusses the study's contribution to suggest detrivialization as a method of examining how trivialized matters could construct organizational knowledge.

5. Discussion

In the present study's analysis, we aim to distinguish between scientific facts of weak rhetoric as opposed to scientific facts of strong rhetoric. The former is rather a well-established truth that scientists are unable to justify, especially when they state that they have never thought of or known why it was so. Also, we consider a scientific truth to be of persuasive rhetoric, when scientists account for its origin and can justify its usefulness, in a somewhat consistent way. Our conception of scientific knowledge is rather constructionist; no matter how strong the scientists' justification is, we still consider scientific facts to be contingent and highly sociological in nature (Callon, 1986). The latter author conducted a field study to identify elements and factors that played a major role in the decision making of scientific matters. Non-human elements and factors played a major role in trivialized organizational decisions that people see as scientific, rational, and well thought.

As discussed in the paper's introduction, to *trivialize* is to consider that the matter is not important. In contrast, *detrivialize* is a neologism that we are suggesting in this study to explain the change in one's mind when something trivialized turns out to be important. The use of the word *"(de)trivialize"* is referring to the oscillation between the two positions: trivialization and detrivialization. Concerning the individual detrivialization practices, some participants already started with some degree of detrivializing accounts during the synchronic interviews and increased their detrivialization, during the focused discussions. Other participants (one of them stepped back from his accounts that he made before the interviews) started by trivializing the negative consequences of the standardization of the CO_2 level and ended the interview by detrivializing it, mentioning the possible skews. The lab director detrivialized the issue, all along with the interview, justifying his accounts with details of the potential skews. Still, suddenly at the very end of the interview, he concluded with ungrounded trivializing accounts that the skews are "minimal."

We also found that when we pointed out a contradiction between two accounts or a problem regarding a particular practice, the participants responded to our comments, reframing the dissonance or trivializing the importance of the problem. Discursive tools were used: 1) Switching from the first personal pronouns "we" and "I" (also their equivalents "nous" and "je" in French) to the second personal pronouns "you" or sometimes "people" (also "tu" and "des gens" in French). While the use of "we" (and equivalents) referred to practices that emphasize that things are under control, the use of the inclusive "you" referred to weaknesses implying "you too would do what we're doing," or to practices that are hypothetical rather than confirmed to have been implemented; 2) Using "also," "sometimes," and "it depends" to connect two incongruent ideas and to minimize the contradiction. Finally, we found that some participants used the "yes but no" while others used the "no but

yes" strategies. 3) *"Yes but no"* consisted of agreeing on everything and admitting all the weaknesses of a particular practice but disagreeing (at the very end of the interview) with the idea that the discussed practice should be revised, without backing up such a position. 4)*"No but yes"* consisted of disagreeing and challenging all critiques to the practice, but agreeing that the practice should be revised.

During the collective interviews, the participants started by trivializing the consequences of the standardization of the 5% level. They initially made short and unproblematic answers, as if we have never discussed the complexity before. Furthermore, they did not contradict each other even though they had already made contradictory accounts during the individual interviews. Only when we pointed out the contradictions that we found after analyzing the individual interviews did the participants start to account for the negative consequences of the standardization of the CO_2 level. The same skew risks emanating from the standardization, which were accounted for during the individual interviews, were then again accounted for during the collective interview.

Finally, the participants did not stick to one position, but rather restlessly oscillated between opposite positions. When they detrivialize the negative outcome of the standardization, they provide justifications (i.e. "phenotype change," "shift from in vivo model," and "blinding"), but when they trivialize it, they mention two reasons: 1) that they need to standardize, to align with oncology research practices worldwide, without detailing the advantage of such an alignment; and 2) that other labs if they want to replicate any of this labs' experiments, they will do it using 5%. Furthermore, we found that the participants avoided on many occasions to respond to the following two questions, regarding the two reasons they mentioned: 1) why do you need to standardize a condition that you say that it may skew your experiments? And 2) if other labs are interested in replicating your experiment, why don't they use the level that you would anyway mention in your research protocol and which you would decide to be suitable to your type of cells? The next section concludes by suggesting detrivialization as a strategy of challenging organizational groupthink.

6. Conclusions

A major concern of the present research was to reflect on how organizational knowledge is constructed by studying detrivialization. Could detrivialization function as a strategy of challenging organizational groupthink? The case study reveals that almost all lab members said that they had never thought about such issues before. The study discusses groupthink as an organizational dynamic that affects people's knowing activities and perhaps puts organizational communication capacities at stake. This paper highlights the role of ethnomethodology and discourse analysis in understanding aspects of organizational knowledge construction. Also, the paper concludes that groupthink is an organizational communication dynamic that is responsible for knowledge construction on two levels.

The first level of groupthink resonates with what Foucault (1969) identifies as "a microphysical power." Groupthink is a hidden and unnoticeable dynamic that could construct organizational knowledge on the background (Hallgren, 2010). More precisely, the detrivialization of this issue emanated from the problematization of what participants call: a) the existing knowledge, b) the standards, c) the practical knowledge, and d) the previous validation. This underlying power could also be explained by the robustness of the "structure" (Giddens, 1984) and its supremacy over the "agency." The participants were defending the "structure" when they embodied it against their knowing freedom- "agency."

The second level is illustrated through the dynamic of knowledge automatization when participants were visibly aiming at converging, conforming, and agreeing, particularly during the diachronic interview. This dynamic is similar to Janis (1982)'s *groupthink*, which occurs in various organizations. Groupthink causes individuals not to be able to dare to ask new questions or to practice their knowing activity genuinely (Janis, 1982). This study argues that groupthink occurs when people feel that they might destabilize the group's harmony and homogeneity by not challenging trivialized matters.

Studying this case of detrivialization from a discursive psychological point of view enabled us to zoom in and out between the following three levels that come into play concerning how knowledge is constructed: 1) the (inter)organizational level; 2) the individual level, and 3) the group level. The study suggests a three-level organizational interaction model to explore groupthink as an organizational dynamic responsible for knowledge construction.

1. The Organizational Level

Our first question was confronted by a long-established trivialization that is rather an organizational default condition or tradition (structural), a standard of unknown origin, than an individually-motivated or an explicit group decision. Nonetheless, the same trivializations were, to some extent, group and individual practices. No matter how 'passive' or inadvertent these practices are, they are, to some extent, choices made by the participants (researchers) during the design of their research protocols. Before our breaching experimental questions (Garfinkel, 1967), the trivializations were unnoticeable conditions and taken for granted practices. The moment our questions came up to the surface, the trivialization started to be noticed. Noticing the long-established trivialization and especially what underlies it in terms of consequences for their research was the first spark of detrivialization.

2. The Individual Level

During the individual interviews, participants were invited to reflect and account for the previously (personally but less formally) discussed issues. Right from the beginning of the interviews, we made it clear that accounts such as "this or that condition is a standard" would not suffice, by responding "what is the rationale of this standard?" Similarly, if the participants say, "this is an existing knowledge," we would respond, "why do you need it? Or how useful is it for your research"? Consequently, the individual participant embodied the whole lab and sometimes the whole research domain, because he or she needed to explain the rationale of the research practices, for which they are not directly or personally responsible.

This study illustrated how participants restlessly oscillated between two stances: the "cozy but imprisoning structure" and the "free but uncomfortable agency." Individually, they tend to say that they are following a standardized process, which is beyond their control, and that applies to the whole domain. But when they fail to justify or explain the situation, they do not identify with it (the standardized process) and would prefer to move to another position, where they are free to criticize the status quo. And once individuals are settled in new positions, they would notice that in reality, much of their previous research was done differently, which makes this new position equally uncomfortable. The oscillation between the two positions was less frequent than in the diachronic and collective interview but was equally related to the contradiction that we pointed out.

3. The Group Level

The diachronic and collective interviews were conducted about six months after the last individual interview. The participants knew in advance that the interviews were going to be about the same questions that we discussed individually during the synchronic interviews. No matter how divergent their accounts and positions were during the individual interviews, they dramatically converged during the collective interviews. The result was that participants collectively and recurrently oscillated between two opposite positions, in five steps:

1. participants start by selecting and playing up a single aspect that demonstrates the accuracy of their practice (under discussion);
2. researchers point out another aspect that participants ignored or played down unintentionally (based on what some of them mentioned in the individual interviews to be of greater importance);
3. participants account for the negative aspect of the trivialized practice and consequently detrivialize the issue;
4. participants change their original point of view and reach a new conclusion (participants do not expect to reach consensus as individuals might insist that this is a matter of personal judgment);
5. researchers step back to adopt a detrivializing position to bring up the previous argument and seek for new justifications regarding the discussed practice. Hence, the oscillation between steps one to five was visibly recurrent and reflected the restless state of the group.

Figure 1 - (de)trivialization dynamic model- depicts the existing trivialization that preceded our present study and the detrivilization provoked by this research, at the three levels described in this section.

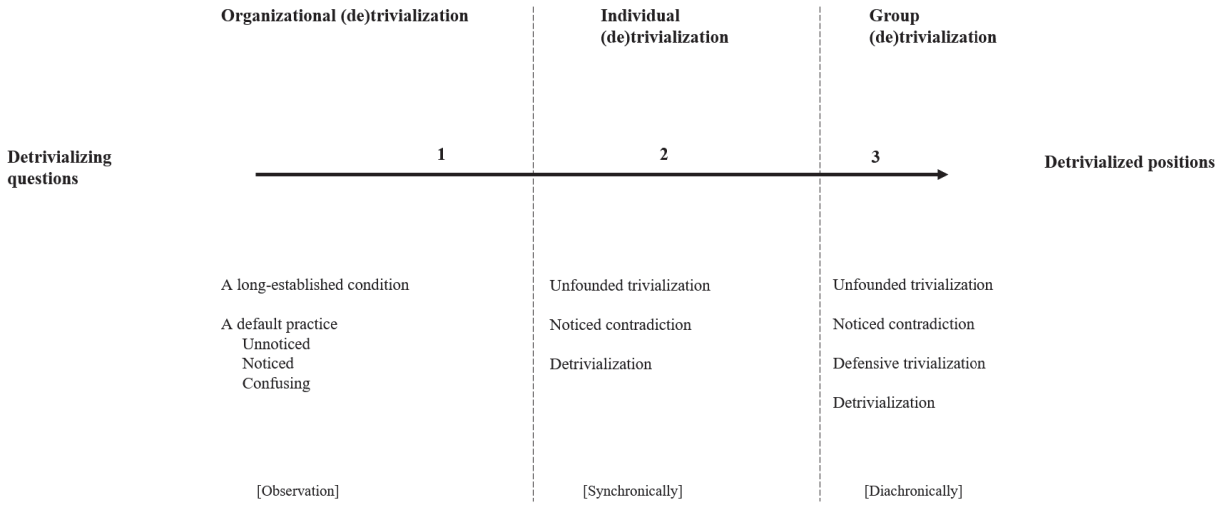

Figure 1: The (de)trivialization dynamic model

The (de)trivialization dynamic model portrays this paper's suggestion for exploring *trivialization.* The model exposes what our *detrivializing* questions faced at three levels: a) the (inter)-organizational level (as a long-established condition or practice within this lab but also in almost every cancer research lab in the world); b) the individual level (how our participants responded to our questions, individually); and c) the group level (how our participants conducted themselves during the collective interview).

Organizations could study participants' knowledge bases through a series of detrivializing questions and interviews, as suggested by the present study. This paper concludes that regardless of people's level of education, organizational culture is more potent than the individual's knowing capacity. The periodic application of detrivialization as a strategy to challenge groupthink and construct knowledge could apply in various organizations.

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Relevance of Adult Higher Education on Knowledge Management in the Healthcare Sector

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Abstract: Organizations, including the healthcare sector, are subject to changes in market, technology and regulations. This requires enhanced and different types of knowledge, and has led to an increased demand for adult higher education. However, the competencies required need to be met by the providers of higher education. This article presents a qualitative case study investigating the work relevance of an adult education study bachelor programme for middle managers of the public health sector in Norway. The paper explores how the education has shaped the interplay between the student/practitioner and his/her surroundings. The data in the study have been collected using in-depth interviews. The case study showcases the potential impacts of higher education within public healthcare management in the workplace, also highlighting the factors that are predominant regarding the application and dissemination of formal knowledge in the workplace. The primary findings of this study are that there is an interplay between the form and content of the education, personal capabilities and individual characteristics of the student (employee/health manager), as well as an organizational maturity pertaining to knowledge-management and the exposure to organizational innovation in the broader healthcare system. The case study contributes to the field of knowledge management issues by showing how a study programme can support the development of knowledge management practices in an organization, through focussing on the relevance pronounced through the management practices.

Keywords: relevance, higher education, knowledge management practices, healthcare sector, innovativeness

1. Introduction

Higher education institutions increasingly offer formal education programmes to work-active adults. We know relatively little about the factors that determine the relevance of these programmes for the workplace and employee, not to mention all ordinary tertiary educational programmes at the bachelor and master levels. One example of the most recent evidence of such a policy interest is the report from the Expert Group on Life-long Learning, commissioned by the Norwegian Ministry of Education and Research (NOU 2019:12, 2019).

In this article, we investigate which factors may determine the work-relevance of an adult-education bachelor programme specifically designed for middle-management employees in the Norwegian healthcare sector. The municipalities in Norway are responsible for elderly homecare and healthcare in nursing homes (Strandquist and Adal, 2011). Through the Coordination Reform from the Norwegian Ministry of Health and Care Services (2009), the municipalities were designated a central role within healthcare. Seeking to establish a more sustainable healthcare system, one of the challenges was to redirect resources from specialized healthcare at hospitals to preventive health activities (Strandquist and Adal, 2011). This led to a demand for more research-based knowledge on how to shift the attention of management towards new methods for more preventive healthcare at homecare and nursing homes, and less curative and/or palliative care at the hospitals. Improved knowledge management practices will aid the managers in the healthcare sector in meeting the increasingly new responsibilities and impacts on organizational performance in the knowledge-intensive healthcare sector (Kianto, et al., 2016, Sousa, 2019).

For Knowledge Management scholars and practitioners, we hope that this paper contributes to a better understanding of the particularities and complexities that knowledge management practices entail in a setting of a regional public health system under reform.

Against this policy and cognitive backdrop, and in collaboration with Fagakademiet and "The Resource Centre for Reorganization in Municipalities" since 2011, the Norwegian Ministry of Health and Care Services has

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funded a Health Management bachelor programme (HMP) offered to the middle management segment in the healthcare sector by The Inland Norway University of Applied Sciences The question we explore in this paper is what factors most likely have been shaping the uptake and utilization of knowledge gained in the HM programme in question by following and studying three carefully selected programme participants (previous HMP students) in their work environment.

For obvious ethical reasons, the identity of the respondents and the name of the healthcare institution and municipality are not disclosed. Figure 1 below shows the conceptual organization of the case study, illustrating the key constituents of educational relevance at work in our analytical focus: reflective practice, knowledge sharing and Empowering Leadership (EL), thus enabling innovativeness, connective communication and competency planning.

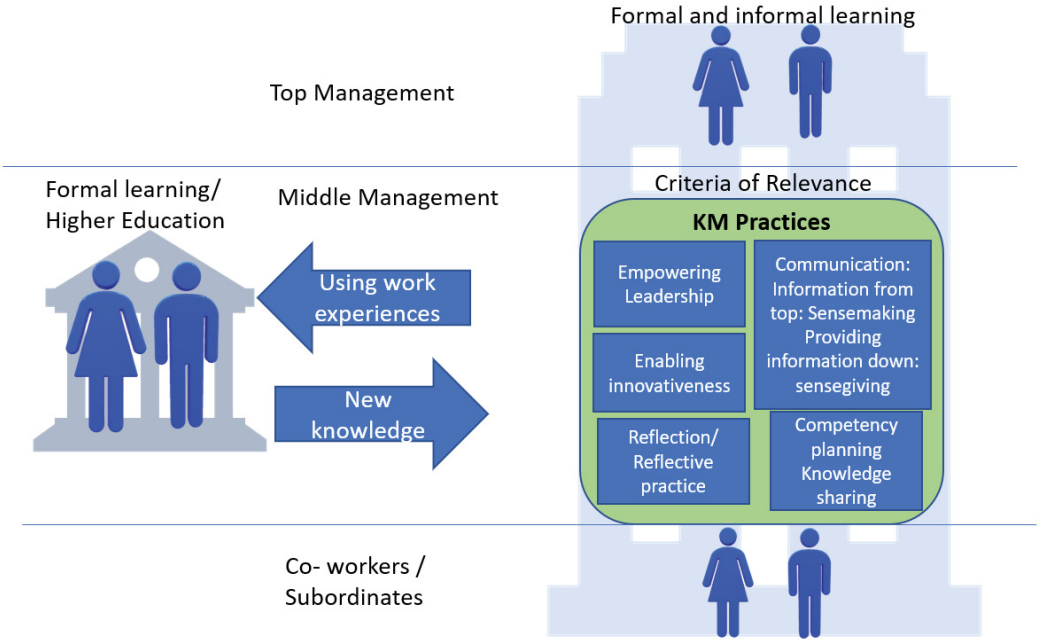

Figure 1: The conceptual framework of the study

The research questions of the study are:

- What are the students' experienced outcomes of the HMP?
- What is the impact of the HMP in the organization?

In the following, we will present the theory that has guided our study, the method of inquiry and the case description. We then present and discuss our results, followed by a conclusion.

2. Theoretical foundation

We argue that "relevance" is a dynamic social phenomenon involving actor interactions and sensitive to contextual settings (Hidi and Renninger, 2006, Vold, et al., 2020). As such, it invites the amalgamation of theoretical approaches from different strands of literature in order to comprehend in a meaningful way the findings of our empirical study. We therefore draw theoretical perspectives from disparate research areas such as: adult learning, individual and group learning, learning culture within organizations, reflection and reflective practice, empowering leadership, and of course knowledge management.

Relevance is a keyword in our study. Since an organization is the sum of its members, and depends on learning among the employees in order to learn and develop, it is important to first look at relevance on an individual level. Secondly, we need to establish how personal relevance can be obtained for the relevance to have an impact on the organizational level. Principles on adult education, such as involvement, inclusion and utilizing the students' backgrounds and experiences, contribute toward the relevance and engagement. It also requires reflection processes in order to develop the knowledge into competency.

For the organization, the relevance will crystalize itself in how the students/employees are able to utilize their knowledge back into the organization, and how they are able to deploy their new knowledge and competencies in order to induce change and innovativeness with their subordinates. Because they are middle managers, it is important to establish any changes in their leadership that have had an impact on the execution of their management and Knowledge Management practices. In order to help define these changes, we need to describe leadership roles within the frames of middle management. It is also interesting to see if there is any meta-learning from the way they have been taught and what they have been taught, which has parallels to whether Empowering Leadership has had any influence on their leadership.

2.1 Relevance

Relevance is a term employed somewhat differently in different contexts. Our point of departure is the understanding of relevance as representing value for the work-life, i.e., value either from the employers' or employees' point of view (NOU 2019:12, 2019). We introduce relevance by focussing on the individual learner.

Rogers (1969) claims that "meaningful, experiential learning has relevance to the whole person, has personal involvement, is self-initiated, is pervasive, and is evaluated by the learner" (Schunk, et al., 2014). This means that the students need to have a motivation to attend the education. This motivation may be both intrinsic, as it may be to learn more and develop as a leader, and extrinsic, such as a pay raise or promotion. Not only the learning, but also the relevance, will be evaluated by the learner. The relevance can be tied to relatedness (Roberson, 2013), while the relatedness can be tied to several factors. It may be a teacher who points out some relevance, and provides a context that can be developed into engagement, motivation and self-regulation (Roberson, 2013, Ryan and Deci, 2017)

Relevance is also about achievement-related choices and performances, and how it relates to success expectancies and subjective task values, in which the task values are intrinsic value, attainment value, utility value and cost value. This is described in the expectancy-value model by Eccles (2014). Expectancy is about a person's belief in their own capabilities, and the value is about whether they will be successful (Schunk, et al., 2014). Regarding relevance, utility value corresponds with personal usefulness, whereas attainment value corresponds with identity (Eccles, 2014). An example of expectancy-value intervention is about inviting students to write exercises that relate to their own lives.

Relevance is also discussed from various theories, such as the four-phase model of interest development of Hidi and Renniger (2006). They have defined situational and individual interests, in which individual interest is about being able to engage with a topic or activity over time, while the situational is about having an interest for something and being taught or coming across related topics, topics that are possible to tie to the interest. Their four-phase model depicts how a situational interest can develop into an individual interest. Initially, the situational interest is generally triggered externally through what may be, e.g., learning conditions, such as group work, etc. Phase 2 is where the interest is prolonged through, e.g., meaningful tasks and/or personal involvement, tutoring, etc. Phase 3 is where it is now an emerging personal interest that, through positive feelings, stored knowledge and stored value, arises. Phase 4 is where the interest is often self-generated, and can be long lasting, as it is now well developed. It is in this phase that students begin to pursue their cognitive interests at deeper levels.

The self-efficacy and expectancy-value point to a personal meaningfulness, what Rogers (1969) called relevance. Priniski, et al. (2018) has summed up the personal meaningfulness in a continuum for relevance. An association indicates an indirect meaningfulness. One example of this may be an article on single- and double-loop learning in a course on organizational theory that also informs a work situation, such as understanding about single- and double-loop learning at the workplace. Personal usefulness is something that may aid in achieving a personal goal, as reading an article may contribute to solving an assignment. The last and most meaningful type of relevance is identification. Thus, learning about leadership styles may support the understanding and identification with that type of leadership.

2.2 Adult learning

In order to achieve optimal learning, adults need to be activated (Rogers, 1969).There is now a sufficient body of literature asserting that adult students learn best by being activated (Fezile and Gulsum, 2016, Vold, et al., 2016, Vold, et al., 2017, Vold, 2014), and by being included and involved in the teaching process (Knowles, et al., 2005, Knowles, 1970, Knowles, 1984).

Including and involving the students in developing the assignments helps to develop a sense of commitment (Filstad, 2016, Nonaka, 1994). The students may draw from their own problem areas at work, work situations and challenges, and discuss and debate real problems with fellow students and with the lecturer. This approach may be experienced as relevant, as many of them are motivated intrinsically or extrinsically to learn more about how to resolve issues at work. Intrinsic motivation is about the motivation that lies in the work execution, whereas extrinsic motivation is the motivation that comes with bonus, pay raises, status, better jobs, etc. (Deci and Ryan, 1985, Ryan and Deci, 2017). The intrinsic motivation stems from two basic needs: 1) the need for self-determination, and 2) the need for the experience of enhanced competency. Deci and Ryan (1985) claim that the intrinsic motivation is "healthiest", as this is tied to an inner desire to perform.

Social cognitive theory describes how one may learn models, skills and/or behaviours, which they may not utilize at the time of the learning, but are still nonetheless able to use them at a later time when they are motivated and/or find the situation appropriate. Bandura expanded the social cognitive theory with his "perceived capabilities to learn or perform action at a designated level" (Schunk, et al., 2014) – also called *self-efficacy* (Bandura, 1997).

In social cognitive theory, a key assumption is that one can have control over certain events in their lives, and feel a sense of empowerment, self-determination and mastery. Through learning from a teacher, and then practicing and obtaining feedback, they will improve their skills. They also learn from the consequences of their actions, and adapt behaviour according to how they perceive their models. If the models are too flawless, one may not learn and adapt as much as one does from "coping models", in which one's performance improves over time. Reciprocal teaching is also a term in social cognitive theory, and describes how the teacher and students swap roles as teacher–learner (Schunk, et al., 2014). Sometimes, the learner needs time to assume the "teacher role", and the teacher needs to facilitate for the learner to adapt.

The person's judgement of their capabilities to organize and execute tasks, or a person's self-efficacy (Bandura, 1997), may differ, and is enhanced by feedback and the self-evaluation of progress. This also works in groups, with conformity and compliance needed in order to facilitate learning. The teacher may use role models and involve the students. Examples of self-efficacy are about completing the activities necessary for learning, e.g., study goals. Hence, self-efficacy is about the individual's capability of achieving or mastering a task (Bandura, 1986). The individual's own perception of self-efficacy may supersede the measurable abilities. Bandura's social cognitive theory (Bandura, 1986) highlights learning from what one has previously learned. By being provided with examples, they can learn over time to execute the tasks and develop the necessary skills or knowledge to accomplish the work they are supposed to do.

2.3 Reflective practice and learning culture

Two major approaches to activating students are using reflection enhancing teaching processes and relevant assignments. Reflection is a major key for learning (Filstad, 2016, Kolb, 1984, Schön, 1987, Schön, 1991). Reflection processes are often tied to experiences, and the experience in a learning setting may often be the assignment, as the assignment can be work related or from the student's actual work-life. Schön (1991) (Schön, 1987) describes reflection processes before, during and after "action", with "action" meaning the students´ work experiences.

Reflection processes assume many "shapes": anticipatory and retrospective reflection, critical and emancipatory reflection, reflection in and on action - such as assignments, reflection in action on action, including when testing back in the workplace, self-reflection and reflection for improvement (Ghaye 2007). Moon (2004: p. 80) defined reflection as "a process, that seems to lie somewhere around the notion of learning and thinking. We reflect in order to learn something, or we learn as a result of reflecting - so 'reflective learning' as a notion simply emphasizes the intention to learn as a result of reflection". Dewey (2005) argued for the supremacy of "learning by doing", which implies reflection on the performing activity, i.e., "doing". Kolb (1984) developed this further in his "experiential learning cycle", in which reflection plays a major part. It is the reflection upon action that decides what you take from the action, and defines the basis for the new action.

Filstad (2016) identified some factors that are important when developing a learning culture within an organization (see Figure 2). Developing a common understanding of what constitutes organizational learning is important. It is also necessary to establish how to develop knowledge into competency.

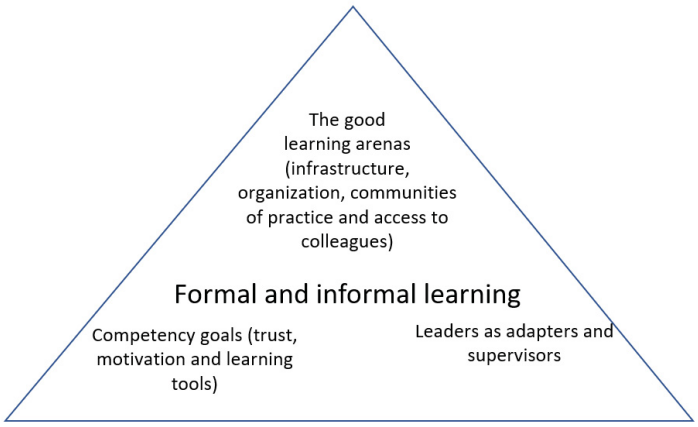

Figure 2: Learning culture (Filstad, 2016)

Learning arenas can be identified as communities of practice and other types of group work within an organization. As the figure shows, goals for competencies may be achieved with trust, motivation and tools for learning. The leaders should function as supervisors in this process, and facilitate for the process of exploiting the learning in both formal and informal learning. There should also be a focus on knowledge sharing and knowledge development throughout the organization.

Formal learning is generally organized and provided by (external) private or public educational institutions, whereas informal learning is learning that takes place in the workplace. It may be in the form of mentorship, Communities of Practice (Lave and Wenger, 1991), learning in teams (Senge, 1992) or something similar. Most of the time, informal learning is not institutionalized and has an instrumental goal. In order to call it learning, it needs to lead to a change in work organization, work behaviour or at least to new detailed knowledge about extant work processes. It is through reflection that learning occurs. The reflections should be about what we do, why we do it and how to find good solutions to problems. Formal learning generally lacks the vivid social and cultural organizational context, and the performative relations present in informal learning settings (Filstad, 2016).

Strategic KM is defined as the: "planning, implementation, and evaluation of initiatives to secure that the organization and each co-worker has and utilizes the necessary competence to achieve defined goals" (Lai, 2013). Lai (2013) also focuses on the term competency, which she defines as: "the collected knowledge, skills, abilities, and attitudes that make it possible to execute the present tasks in line with defined demands and measures". The competencies may be of a formal or informal art, formal being what is learned through education, while informal may be learned at the workplace (Lai, 2013, Raelin, 2008, Filstad, 2016, Irgens, 2011).

Regarding work-based learning, there are three "critical elements" according to Raelin (2008):

- It views learning as acquired in the midst of action and dedicated to the task at hand.
- It sees knowledge creation and utilization as collective activities, wherein learning becomes everyone's job.
- Its users demonstrate a learning-to-learn aptitude, which frees them to question underlying assumptions of practice.

Raelin (2008) claims that work-based learning is different from formal learning initiatives, as it involves a "conscious reflection on actual experience".

The challenge is that the knowledge from the formal setting needs to migrate to- and be practiced in an informal setting in order to become "relevant" learning (Filstad, 2016). According to Filstad (2016), learning in the workplace requires time. However, time is a scarce resource in many organizations. To allocate time for knowledge sharing requires a prioritizing that is sometimes difficult to balance, hence, the importance of managers who prioritize this and point out occasions for knowledge sharing, in addition to facilitating for knowledge-sharing activities.

Still, it is important that the members of the organization are taking part in this development. This requires enabled subordinates who can make use of the new knowledge and perform innovative behaviour.

Innovation is about developing something new, such as a product, service or organizational method (EUROSTAT, 2005), whereas innovativeness is about being able to contribute actively towards this (Støren and Arnesen, 2016). The OECD (2010) has defined a learning organization, "as an organization that promotes management tools concerned with the improvement of individual and organizational learning" (p. 9). A learning organization, in combination with autonomy among the subordinates, supports innovativeness, which is defined as being able to actively contribute to innovation (Næss, et al., 2009, Støren and Arnesen, 2016, OECD, 2010).

According to the OECD (2010), among the factors influencing innovativeness in the workplace, are a leadership focussing on mastery and an organizational context that embraces changes in customer focus and organizational learning.

2.4 Empowering middle management

Mastery is about being enabled to learn, with one of the definitions from Merriam-Webster (2020) being that mastery is a "skill or knowledge that makes one a master of a subject". According to Senge (2006), in organizational learning "personal mastery" enables a person to learn and contribute within an organization. Personal mastery is one of five disciplines that Senge (2006) refers to in a learning organization.

For a leader to obtain this mastery in his or her subordinates, it is important to create and support an environment in which subordinates are supported and encouraged to actively contribute to cultures and relationships within the organization, which enables a utilization of the new knowledge. Woods (2005, p. 14) refers to a "Democratic leadership", which "aims to create an environment in which people are empowered and enabled by the institutional, cultural and social structures of the organization". He further states, "Democratic leadership contributes to leaders' and others' growth towards human potential" (Woods, 2005). One example of such leadership is found in the curriculum of the HMP: "Empowering Leadership".

Empowering leadership (EL) is about enabling and supporting subordinates in order to become autonomous through sharing power and delegating responsibility (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015, Kim, et al., 2018). Leadership is generally about deciding over and making subordinates execute the orders (Yukl, 2010). EL stands in contrast to the facilitation of making subordinates autonomous, empowering leaders to delegate responsibility, thus giving the subordinates a higher influence regarding their work and sense of autonomy. Empowering leaders through encouragement, positive persuasion and emotional support, and by being role models, can make subordinates feel more included, autonomous and competent (Bandura, 1986, Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015). To pay attention to the subordinates and listen to their ideas, suggestions and opinions may contribute to their feeling of competency, which in turn may contribute towards the subordinate's ability to make decisions (Amundsen and Martinsen, 2015, Amundsen and Martinsen, 2014). According to Amundsen and Martinsen (2015), the subordinates stand a better chance of improving their work's results.

The subordinates need to lead themselves, and rely on themselves in order to be autonomous. Facilitating EL involves sharing power to help promote the subordinate's energy and effort regarding the handling of autonomy. Therefore, they need to provide motivational support, as well as supporting them in their development of skills and competencies (Amundsen and Martinsen, 2014).

Jacobsen (2019) defines middle management as a "hierarchical position where the leader has some leaders in a level above with more authority and other managers in the level below and with less authority". Consequently, middle management needs to relate to both levels. Yet, according to Jacobsen (2019), there is little research on the role of middle management. Middle management is a communicator of information, and has a role in both strategy processes and change processes (Jacobsen, 2019, Hope, 2015). Top management is generally focused on results, effectiveness, safety and a satisfactory work environment.

On the other hand, middle management plays the role of the "translator", as they "translate" the subordinates' needs and what they consider to be the most vital consequences from different options, synthesizing these into information for top management. Also, when a strategy is decided upon by top

management, this needs to be "translated" into what this means with regard to new routines and guidelines for the subordinates, which lead to new KM practices.

2.5 Knowledge Management practices

Knowledge Management (KM) is about collecting, sharing and utilizing knowledge (Davenport and Prusak, 2000, Davenport and Prusak, 1998). The set of management activities that support the utilization of knowledge in organizations to obtain the best possible effect are called Knowledge Management (KM) practices (Andreeva and Kianto, 2011, Andreeva and Kianto, 2012, Kianto, 2019). The practices should be systematic and intentional to support knowledge sharing and dissemination among the members of an organization. It is also important to note that it is not so much about the practices as such, but more on how the employees perceive and interpret them (Kianto, 2019). Changes may be difficult to induce, and there may be resistance to changes. The resistance may be less over time as the initial "shock" follows a curve that over time ends up in "compliance", meaning they have accepted the change (Irgens, 2011, Hayes, 2002). KM and KM practices are generally applied to support innovation, effectiveness and a competitive advantage (Donate and Sánchez de Pablo, 2015, Nonaka and Takeuchi, 1995, Von Krogh, et al., 2000). KM is also tied to organizational learning. This involves seeing the organization as a system, building and facilitating communities of practice and learning, focussing on personal mastery and personal development and supporting self-organizing within the organization (Davenport and Prusak, 1998).

A precondition for a learning organization is that the individuals learn (Filstad, 2016, Irgens, 2011). As we have described above, the learning arenas can be both formal and informal. When the learning is adapted to adults, this is based on many of the same principles we find in norms from democratic leadership styles. It is about empowering the learner in order to be more autonomous, thereby enabling the learner to feel mastery and being able to be innovative. Consequently, it is important to notice the possibility for both middle managers AND subordinates to learn in the organization by educating the middle managers in Health Organizations. For example, learning about EL will support the leaders to empower not only themselves, but also their subordinates. However, this also requires that the learners (the middle managers) find the curriculum relevant for their work situation, and that they can identify with what is being learned. Learning about EL in a formal setting and learning in an informal setting by experiencing and reflecting (Schön, 1987, Argyris and Schön, 1978, Schön, 1991), together with their peers and with their subordinates, may prepare for innovativeness with their subordinates. It is important to understand how adults learn and what constitutes relevance to them, in order to establish the relevance that enables them to "convert" the knowledge back at the workplace and turning it into competence. We present a theory that will enlighten us on how higher education (HMP) will impact the Knowledge Management (KM) processes in organizations.

Being empowered as subordinates and receiving the motivational support enable the development of skills and competencies, which in turn will affect the Knowledge Management practices within the organization. The middle manager needs to understand the culture and contradictions, and utilize the systems within the organization to guide the subordinates in the knowledge creation process (Holtskog, 2014, Holtskog, et al., 2018). Knowledge-sharing behaviour may also support knowledge-sharing tendencies, as well as strengthening individual performance (Henttonen, et al., 2016). Hence, the management's role in facilitating conditions in which subordinates are willing (and able) to utilize their knowledge and share it with co-workers is important (Sousa, 2019). Nonaka and Takeuchi (2019) support this, as they claim that it is necessary to foster distributed leadership in order to share knowledge within an organization.

3. Research design and methodology

We assert that the phenomenon we are investigating in this paper can be best studied by applying a case study methodology. Yin (2009) defines a case study as "..[an] empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident". Studying work-life relevance of an adult education programme is almost by definition a "contemporary phenomenon", with blurred boundaries with organizational context.

Vold, Haave and Kaloudis (2020) is a previous recent example of a case study investigating the issue of relevance at the workplace of a specific adult education programme of a private Norwegian company. In this paper, we emulate the same methodological approach as in Vold, Haave and Kaloudis (2020), but with some key differences in order to adjust and fully exploit the richness of the case study at hand.

The purpose of this study is to describe and explore how participation in the specific HMP can qualify as educational activity of relevance for the organizations where the participants are employed. Hence, we do not seek to evaluate whether the learning outcomes of the HMP are achieved in an effective and efficient manner or not. For this type of study, the case study approach allows us to better understand the interplay between HMP learning outcomes and managerial practices within the work-life context by opening the possibility of developing "thick descriptions" of the situation (Geertz, 1973, Remenyi, 2012), as the case study approach will provide a deeper understanding of the interplay between people, phenomena and organizations (Weick, 1995, Berg, 2007).

We have selected three main informants and participants of the specific HMP-programme we are interested in for this case study, two women and one man. The criteria for selecting these informants among all of the participants of the actual HMP were that: a) they were participants in the HMP programme; b) had completed this education in about the same time, and c) held a management position in the Norwegian healthcare system in the same municipality. They were therefore expected to have relevant formal knowledge and middle-management experience for this study.

The fact that the three informants were also working in the public healthcare organization in the same municipality made it possible to demarcate and define them in our case study, and enabled us to compare and examine factors that shape the impacts of the HMP on work-life practices, given that several context variables are now held constant, i.e., the size and geographical location of the organizations, the differences of healthcare system needs and operational logic between municipality and county boundaries, etc.

To understand how HMP participation induced changes in behaviour and the leadership style of our three informants, it is not enough to only collect information from our key three informants. The novelty of our research design is that, in addition to these three "protagonists", we also interviewed their superior managers (two persons) and one of the subordinates of each one of them (a total of three persons), all from the same organizational unit our main informants worked at. This makes a total of eight in-depth interviews, as two of the main informants had the same manager. This research design allows us to triangulate the opinions of the main informants with other actors in the same organization and, therefore, to explore the potential effects of the participation in the HMP on the organization, investigated through the personal experience lens (the three previous students), and validated (or not) through the lens of the superior managers and the lens of the subordinates.

3.1 Data collection strategy and analytical method

We employed the method of semi-structured in-depth individual interviews with "experience and behaviour questions", "values questions", "feeling questions" and "knowledge questions" (Patton, 2002). The interviews have been transcribed, and from the material we have developed empirical categories used to analyse the data, and relate them to the theoretical categories developed in section 2.

The first key question is to investigate whether the three main informants (1.1, 2.1, 3.1 in Figure 3 below) have developed or improved skills and changed attitudes on the basis of what they learned in the HMP. In particular, we are interested in two types of "behavioural changes"': a) "Leadership development", and b) "change of daily practices and routines".

Figure 3 exhibits the interviewees and their position within the municipality healthcare organizations. We have defined the middle tier as the HMP participants, the top tier as their managers and the bottom tier as the co-workers/subordinates.

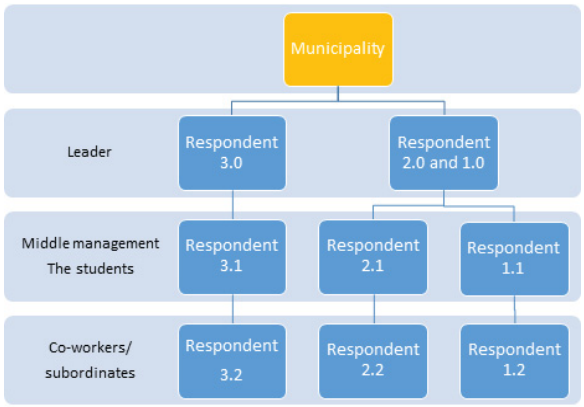

Figure 3: Overview of respondents

Patton (2002) describe different types of questions that apply to most topics. All the respondents were a subject of an introduction, and asked about "background information". On an individual level, it was age and how many modules they had finished, while on an organizational level it was about their position within the organization. Regarding "experience and behaviour questions", we have, e.g., asked about changes in behaviour and routines and what has changed. The main respondents replied regarding their own opinions about their work, with their managers and subordinates also asked about observed changes in behaviour. "Opinion and values questions" are primarily about how the HMP has met their expectations. One example of a "feeling question" is what the HMP has contributed with regarding how they feel in their work situation, with "knowledge questions" targeting what they have learned, both from the main respondents' perspectives and how the managers and subordinates perceive it. We have focussed on the past and the present in the interviewing. The table below is modified from Patton's "Matrix of Question Options" (Patton, 2002).

Table 1: Types of questions asked of the eight interviewees. Numbers indicate the code number of the interview from Figure 3

Question focus	Past	Present
Behaviors/experiences	1.1, 2.1,3.1	All respondents
Opinions/values		All respondents: Students (1.1,2.1,3.1): own opinions tied to own situation Leaders: (1.0,2.0,3.0) opinion on function regarding main respondents Subordinates: (3.2, 2.2, 1.2) opinion on function regarding main respondents
Feelings/emotions	1.1,2.1, 3.1	1.1,2.1, 3.1
Knowledge on leadership	All respondents	All respondents
Background information (individual)		All respondents (age and finished modules)
Background information (organization)		All respondents (position within organization)

4. Case description

The Norwegian Directorate of Health required that a large number of the management staff in the healthcare system should undergo a management training programme specifically designed for that sector. The Inland Norway University of Applied Sciences (HINN), together with Fagakademiet and "The Resource Centre for Reorganization in Municipalities" (translated from the Norwegian: "Ressurssenter for omstilling i kommunene"), won the tender.

These managers are to lead complex organizations that have high expectations regarding cooperation and collaboration across different subject areas, in addition to interactions between their workplace within a municipality and the specialist health service. On the local level, it is about recruiting, adapting for a healthy work environment and utilizing and deploying resources accordingly. More concretely, it is about the management of empowered workers, the development of competencies, the development of quality in the

organization, the development of management skills, and last but not least, about how to establish and promote collaboration among the various actors within the healthcare services.

The education was decided to be offered in the municipalities where the students worked. It was the lecturers, not the students who travelled to the teaching venues. The educational programme that our respondents have been a part of consisted of eight modules of 7.5 ECTS. The study is seminar-based, with one of the requirements being to utilize the students' workplaces as a living laboratory, thereby generating illustrative examples and case exercises during the study period.

Our three main respondents are from the same municipality and same healthcare division, but from three different departments: home care, nursing home - long term and nursing home - short term. During their study period, they formed a group of three that studied together and had group exams, which has been important for them in their learning process.

5. Results and discussion

5.1 What were the main experiences from the Health Manager Programme?

We find that there was an established demand for more education when the HMP presented an offer to the health managers in the municipality. According to the unit managers (see Figure 3), there were high expectations in the organization, as this was what the middle managers needed to better accomplish the challenges of change processes and ongoing projects within the organization (respondent 1.0, respondent 3.0).

The three previous students were all trained nurses with a long work experience, and two of them had already worked for some years as middle managers. The third was new in the job as a manager at the time, and needed additional management education to better cope with the work (respondent 3.1). Two of the students expressed that they had asked for and been promised an HMP education (respondent 2.1., respondent 3.1). According to the health division manager (respondent 1.0), there was a demand for competence on the management level for handling work challenges, as well as a need for individual development as a manager. The third student joined the education after being persuaded by the leader (respondent 3.1).

The overall impression is that all three respondents were satisfied with the learning outcomes of the HMP. They claim that they could now exercise more autonomy and feel more competent due to their adult education. The three former students all reported to have worked well together as a group, and achieved top results (respondent 3.1). We find that the majority of the eight modules in the HMP were rated as of high relevance and quality standards. There were some negative comments, such as the one about one of the lecturers not being up-to-date on the regional project concerning welfare technology. Another area of discontent was the long time (four years) it took from the start to the finish of the study programme. According to one of the respondents, it took some pressure from the participants to make the responsible providers offer the last module to complete the programme (respondent 3.1).

In particular, all three former students point out the relevance of two modules in the HMP. "Planning, Management, and Development of Strategic Competence" has been very useful, as they could use the course content directly into their work as middle managers and project leaders. Likewise, the interviewees have found useful knowledge from the first module, "Management of Empowered co-workers and development of personal leadership skills".

Their superior managers also confirmed that overall the three former students seem to have learned a lot from the HMP study programme (respondent 1.0, respondent 3.0). They point out that two of them have also shown that they have taken new responsibilities in their work. The third former student claims to have learned a lot: "I use the curriculum …to confer for guidance" (respondent 1.1), whereas the manager and subordinate did not see much change in managerial practice (respondent 1.0, respondent 1.2). The subordinate expresses: "I really should have wished that – my leader would have shared more of the experiences from the HMP" (respondent 1.2).

The former students, their managers and subordinates all agree on the positive outcome of the HMP. They express having high expectations and high standards for themselves and their work. As described by Eccles (Eccles, 2014, Wigfield and Eccles, 2000), their performance has been successful regarding their education as

they got top grades, according to respondent 3.1. Since the education is done in parallel to working full time, it is an achievement just to finish. This is in line with Atkinson's Achievement Motivation (Atkinson, 1957), as they have an incentive value to achieve success. They want to achieve good grades, and they have high expectations regarding the outcome for the HMP. This can also be explained by Bandura's theory on self-efficacy (Bandura, 1986, Bandura, 1997), as this is about having capabilities to learn or achieve at a certain level.

Both the former students and their superior managers claim that the education (HMP) has provided them with tools (e.g. strategic competence planning skills and project management skills) to handle their work as administrators and as managers for subordinates. Through understanding that the education (HMP) provides tools and empowers the students as managers, they have experienced the relevance of the study. They understand how they could personally associate the learning to their own work situation, see the usefulness as middle managers and identify with the content of the HMP (Priniski, et al., 2018).

5.2 What were the respondents' learning outcomes of HMP?

Regarding the development towards being reflective practitioners in their role as leaders, the former students all report on a positive outcome.

The HMP was designed as a practice-oriented programme, in which one of the requirements was that the students were to bring in their own workplace experiences and cases to the classes. According to the former students, one of the most important activities during the study programme was the discussions and reflections in groups with other students. Reflection was a central part of education. The possibility of suggesting cases and experiences from their own practices, and reflecting upon them, gave new insight that they could bring back to their workplace. This is also accentuated as an advantage when working together with the group exams; because of their good cases and thorough group work, they got good grades. "We were three [persons] working in group-exams together… sharing experience… a lot of learning in group tests, when the group works well" (respondent 3.1) (respondent 2.1).

The advantage of the students having the same background and thus being able to understand, share and discuss their experiences, has also been pointed out (respondent 1.1). This also led to the development of a local network, as all the former students (in our study) emphasized the benefit of being a group of three from the same municipality. During the study period, they got to know each other on a more personal level, and could more easily discuss matters of common interest and importance with their fellow colleagues. This is confirmed by statements like: "We have written assignments together and we have reflected and have become a good team, you know. We have become closer than before" (respondent 1.1).

As a result of the HMP, the three interviewees report that their respective departments introduced weekly reflection meetings with the entire staff, to have time to discuss and reflect on problems and issues regarding their work practice. Likewise, the top management group is having monthly meetings with a reflection point on the agenda. These are maybe small changes, but they indicate a development towards a learning organization.

To meet with other students from the region during the HMP education contributed to building a network with other health managers, which is useful when working in health projects across the region (respondent 2.1).

Through working on their assignments, they need to reflect upon solutions, reflect on the feedback and adjust according to the feedback and their reflections upon the feedback. This resembles Kolb's experiential learning cycle (1984), as most of this cycle describes a reflection on action and planning for new action based on the reflections.

Since they also have an opportunity to "bring the learning" to their work and "put the learning to work", they also have an opportunity to reflect before action (Cowan, 2006), reflect "in action" as described by Schön and even reflect "in action on action" (1987).

The respondents display different kinds of reflection. Above is an example of the retrospective reflection, and they also show self-reflection and a reflection for improvement as explained by Ghaye (2011), as they are

reflecting on their own activities in order to improve their work and function better as middle managers. They attend the HMP in order to become better at their jobs, and become better middle managers. As a result, the reflective learning reflects the learning as a result of the reflection that Moon (2004) refers to.

We have found that their recurring reflection on their own practice in and during the study programme has enhanced their reflective practice back into their workplace. This has had an impact on their execution of leadership, as they have introduced more reflections in their daily work. Hence, this indicates a new and improved KM practice in their workplace.

5.3 Leadership development

Being a middle manager is about coping with many different tasks. It is about being an administrator of the daily work and handling the staff. It is also about being a facilitator and change maker who helps organize for the subordinates when it comes to trying out new ways to work. This is in addition to being a translator when it comes to presenting and making sense to the staff on the necessity of changes and challenges, and having sustained their ability to communicate (Hope, 2015).

Our material shows that the three previous HMP students all find that going through with the HMP has changed them. They have learned a lot and developed as leaders. The three respondents, two females and one male, were all health managers with a long experience as trained nurses. They were quite similar when it comes to education, work experience and age. In conducting their daily job, they did similar tasks, but we also find that their work performance differed somewhat, according to what they themselves and their managers/subordinates reported.

One of the former students expressed change: “I became more conscious about the role of a manager than I was before.…I didn’t see myself as a leader, more like an administrator, in a way” (respondent 1.1), although this is not the opinion of the surroundings (respondent 1.0, respondent 1.2.). There is a difference between respondent 1.1’s self-perception, and how the manager and subordinate perceive it. The data are not conclusive and yet they point towards the four-phase model by Hidi and Renninger (2006), in which the interest in the subject has come gradually and is still evolving. Within Priniski, et al.’s (2018) model, the respondent identifies with the curriculum, but has not yet been able to fully explore the potential of the learning back in the organization.

The other former student expressed that: “Education has given me new strength as a person.” Having gone through with the HMP, the respondent claims to be taken more seriously, has more influence and is invited to participate in more interesting work projects (respondent 2.1). This “new strength as a person” and engagement outside the organization point towards seeing the personal usefulness, personal association and personal identification regarding the curriculum (Priniski, et al., 2018).

The third respondent was relatively new as a manager, and felt the need for role development and for having a more formal management education. The respondent reports: “It has been a boost in many ways – but most important for me is to feel more confident in the role” (respondent 3.1). The HMP has brought both new knowledge and a chance to develop as a leader, leading to feeling more confident as a manager. This was confirmed by the superior manager: [the respondent] “is more conscious about being a leader…. and has gotten a deeper understanding of leadership” (respondent 3.0). The subordinate’s notion is: “The education has changed the way of being more straightforward as a leader” (respondent 3.2).

One of the respondents had this self-description: “As a person I’m very efficient”, and “struggle when things tend to take too much time” (respondent 2.1). In spite of this, the respondent claims to have managed to motivate the staff to take more responsibility, even if this (at times) can be less efficient, and an expression that confirms this being: “It used to be the managers’ job to fix everything”… “now everyone has a responsibility to contribute” (respondent 2.1). Our data show that the respondent motivates the staff and shares information, which is a part of how to execute EL (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015). How to motivate and share information is a part of what is taught as a part of democratic leadership (Woods, 2005). We also find that the respondent initiates change, and shows innovativeness regarding putting ideas into motion. This may be interpreted as a response to the EL, which enables them to make use of the new knowledge on executing leadership (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015, Kim, et al., 2018).

Respondent 3.1 has assumed the role as a facilitator for change, and accentuates: "If you want to change something, the staff has to contribute, too, they have to have the ideas and feel the need for change." "So, I am responsible for organizing for the subordinates when it comes to trying out more systematically new ways of practice in their daily work" (respondent 3.1). Again, this is a clear indication of executing EL by assuming the responsibility of making the subordinates being able to change practice (Kim, et al., 2018, Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015). It is about empowering the staff. Respondent 3.1 is also very concerned with strategic competence management and disseminating knowledge, who emphasizes informing subordinates and sharing knowledge. These are KM practices supporting information sharing and dissemination (Nisula and Kianto, 2016, Kianto, 2019, Andreeva and Kianto, 2012, Andreeva and Kianto, 2011). Thus, the respondent seeks to allocate resources among the subordinates, and is concerned about their personal mastery (Lai, 2013, Senge, 1992, Davenport, 1998).

All respondents display an understanding of their roles as managers, which they claim to have developed through their study programme. For example, we can assume that the courses on "Management of Empowered Co-workers" and "Development of Personal Leader Skills" have led to a greater awareness about the leadership role. Even if the former students all claim to have learned from the courses, they seem to have reached different levels in their development as middle managers.

We find that there are some differences in how the three respondents perceive their role as a manager, and how this inflicts on their job performance. Two of them are more proactive, take initiative and are oriented towards change, and willing to take responsibility in change processes. The third is more cautious, almost conservative when it comes to changes. A possible explanation to the differences may lie in the level of confidence and sense of self-efficacy (Bandura, 1997, Bandura, 2012). Even if they all have experienced an identification with the EL, there still may be a difference in the execution of EL (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015, Kim, et al., 2018). There may also be a different level of confidence regarding testing out the learning, and continuing learning back in the organization by testing out the new knowledge (about empowering the subordinates). The informal part of the learning is therefore not prominent (Filstad, 2016, Filstad and Blåka, 2007).

The HMP has had an impact on their roles as leaders, even though they have different ways of executing their leadership, which we will look further into in the section below.

5.4 In what way have the respondents changed their daily practice as leaders?

A central part of being a middle manager is being able to communicate with their staff. The previously mentioned enhanced reflection processes are a part of enabling communication and empowerment.

An example to show how respondent 2.1 has changed the daily practice when dealing with the staff: *"I have had to communicate to the staff the importance of empowerment, and that they need to assume more responsibility. This is a change from my earlier leadership practice"* (respondent 2.1) The staff is expected to take more responsibility for the working environment, and for keeping the routines without being reminded. The respondents' notion on the staff reaction is that at first: *"They want everything to be like it always has been… Not all of them want to be empowered, you know"* (respondent 2.1)**.** This may be a resistance to change (Irgens, 2011, Hayes, 2002).

Gradually, the staff finds out that this is not bad, but that it is fun take responsibility, to try out things and to obtain positive feedback (respondent 2.1)**.** They seem to have followed Hayes' curve, showing the resistance to starting in "shock", and over time ending up in a state where they are going along with the change (Hayes, 2002). The subordinate interviewee also confirms that the manager is present in their reflection meetings, challenges the staff, is responsive and makes decisions based on discussions in the group of the staff (respondent 2.2). The reflection of the previous students (middle managers) serves as an important part of the learning process (Schön, 1987, Schön, 1991). The responsiveness and inclusion of the subordinates again point towards the execution of EL (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015, Kim, et al., 2018).

Respondent 3.1 reports that the subordinates have noticed that the respondent has attended an education: *"It has to be the change in the ways of working and of being systematic in developing competence and to stress the need for quality…. And also working with empowering the staff… they shall have the competence and feel*

safe regarding their job execution, and develop their potential resources" (respondent 3.1). This informal part of the learning process (Filstad, 2016) is important to work on executing the empowering leadership (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015). The subordinates recognize the takes on EL and can describe them.

From the subordinates' point of view, this manager has also changed the way of dealing with the staff after going through the HMP. *"Have noticed changes, for instance, when we are supposed to work more independently, we get more responsibility at work"* (respondent 3.2). When questions are raised, the manager gives the staff the responsibility to find the answers or solutions by themselves, instead of taking the lead. By this, the respondent is empowering the staff, while at the same time backing them in a way that makes them feel that they succeed (Amundsen and Martinsen, 2015, Amundsen and Martinsen, 2014, Kim, et al., 2018). The subordinate also speaks well of the manager as a good leader when it comes to support for returning to work after periods of sick leave. The manager was both supportive and firm (respondent 3.2). This implies that they are performing well in their job as empowering leaders. Their practice has "paid off" and their formal and informal learning (Filstad, 2016), including the reflection processes (Schön, 1987, Schön, 1991), have over time developed the primary respondents' leadership styles (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015).

Respondent 3.1 emphasizes work with knowledge development and sharing. Competence planning is systematically used to develop and take advantage of the competence in staff. The subordinates are supported when testing new ideas, as well as when they show innovativeness. *"Everyone shows interest in sharing knowledge, it's spreading like ripples in the water".* The respondent claims that there is a culture for knowledge sharing in the department (respondent 3.1). Competency planning is a part of the KM practices (Andreeva and Kianto, 2012, Andreeva and Kianto, 2011, Nisula and Kianto, 2016, Davenport, 1998), and it is also their contribution towards developing a learning organization (Filstad, 2016, Irgens, 2011, Lai, 2013).

We find that two of the leaders have made changes, making the subordinates take more responsibility for solving the day-to-day problems, which seems to be under the influence of the HMP.

The third claim is to having learned a lot from the education, which is useful in the daily work. The nearest leader and subordinate find there are little changes to the ways of behaviour as a manager, although weekly staff meetings with organized reflection have been introduced as in the other departments. The respondent is a responsive leader, who often asks the subordinates for feedback, and listens to their views on matters such as the work plan, which is seen as a positive trait (respondent 1.3).

Encouraging the subordinates to work independently is about providing them with a sense of autonomy, and to support them regarding competence and relatedness. This support towards being more effective and mastering their task is a predominant characteristic of the Self-Determination Theory (Ryan and Deci, 2017). The positive reinforcement leads to commitment and energy, even though our subordinate respondents (respondents 1.3, 2.3, 3.3) also show signs of resistance to change. However, involvement and engaging subordinates generally results in a higher degree of commitment among the workers (Knowles, 1984, Nonaka, 1994).

The middle managers are able to support and develop intrinsic job motivation with the subordinates, as they have developed their skills within empowerment leadership (two of the main respondents more than the other). By the way, this is shown that they include the subordinates in the reflection processes and the change processes. The middle managers have all learned about EL, but not all have maximized the learning process by implementing the EL back in their workplace (Filstad, 2016).

5.5 What is the impact of the HMP in an organization? The development of KM practices

We find that there have been changes in the KM practices in all three healthcare departments previous to- and after the participation of our three respondents in the HMP. Evidence from the discussion above suggests that the HMP had the following impacts on the three departments:

- *the introduction of more systematic and reflective cognitive activities regarding the organization and management;*
- *a more systematic competency planning;*
- *a more active knowledge sharing; and*

- *a leadership style more towards the direction of Empowering Leadership.*

Since education within healthcare (nursing education, etc.) contains a substantial amount of training in becoming reflective practitioners, we can assume that they have been doing some form of reflection processes prior to their education at HMP. However, the evidence of an enhanced and more encompassing and systematic reflection is claimed by the respondents, their superiors and their subordinates.

Based on the results above, we also discuss the impact of the HMP within the organization, and how this has affected the development of the KM practices. The formal education that the HMP represents has provided the students with the tools and knowledge to further develop informal arenas back at the workplace. Through the HMP, the students have acquired tools and developed strengths to aid them in the process of becoming better at their jobs as middle managers, and clearer in their communication.

A requirement for all the students at the HMP is to bring their own practice into the learning, and thus make it situated. Our findings show that utilizing the students' work-life situations as a basis for the case-based part of the learning processes at the HMP strengthens the learning process back at the workplace. When Raelin (2008) discusses work-based learning, he claims that this is different from formal learning. The "conscious reflection on actual experience" is not a part of the formal education, claims Raelin (2008). Even so, we do see the opposite when using the students' own background and work-life when developing cases.

This contributes to establishing relevance, not only for the individual, but also for the workplace, as the students are able to project the discussed solutions back in their work situation.

Our material shows that the formal learning at the HMP is continuing as informal learning back at their workplace. Filstad's (2016) model of Formal and Informal Learning (see Figure 2) conditions that the students in formal learning do not also work together, which is the case in our investigations. Her claim of the discontinued learning process between formal and informal learning is probably the most common situation. Yet, this is one of the benefits for the HMP; the co-learners at the HMP are the same as the co-workers (and, hence, the co-learners) back at the workplace. Even if the co-workers are in different departments, they are under the same employer, and have access to co-reflecting processes. This also strengthens them in their process of facilitating reflection and learning processes for- and together with their subordinates.

The synergy of the formal learning (at the HMP) and informal learning (at the workplace) has contributed to the transformation and implementation of their learning at the workplace, which has strengthened the development of the KM practices. We have established the connection of the HMP regarding enhanced reflection processes and more systematic competency planning. Enhanced reflection processes have also supported KM practices, such as knowledge sharing and development. Our case study showcases that through reflection with peers (co-students) and through practice, the Empowering Leadership has been strengthened and further developed. The figure below (Figure 4) also embraces the important preconditions for these synergies; it is based on theories on adult learning; the students in question (the middle managers) already have a vocational education, and the organization has a high level of maturity regarding learning culture.

Systematic reflections and learning in the organization have supported the culture for learning. The way the students facilitate, and are ideals for their subordinates regarding the competency planning and reflection processes, make it easier to follow up in the organizations and provide the basis for culture for learning, as this is also a managerial issue. The students have seen it as their role as (middle-) managers to facilitate reflection within the organization. A learning culture needs a continuous focus on learning and knowledge development. It is also necessary that the leaders at all levels have a focus on learning which facilitates learning and knowledge development. There is a need for establishing a learning arena that supports and recognizes informal learning between the leader and the subordinates, as well as integrating formal and informal learning (Filstad, 2016). Through establishing the reflections, the leaders are also facilitating learning and knowledge sharing among the subordinates. The management has encouraged the development of a learning arena on several levels. However, learning needs a focus and a goal (Filstad, 2016).

Still, it is not only about changing the KM practices, but also about how the subordinates perceive and interpret the new KM practices (Kianto, 2019).

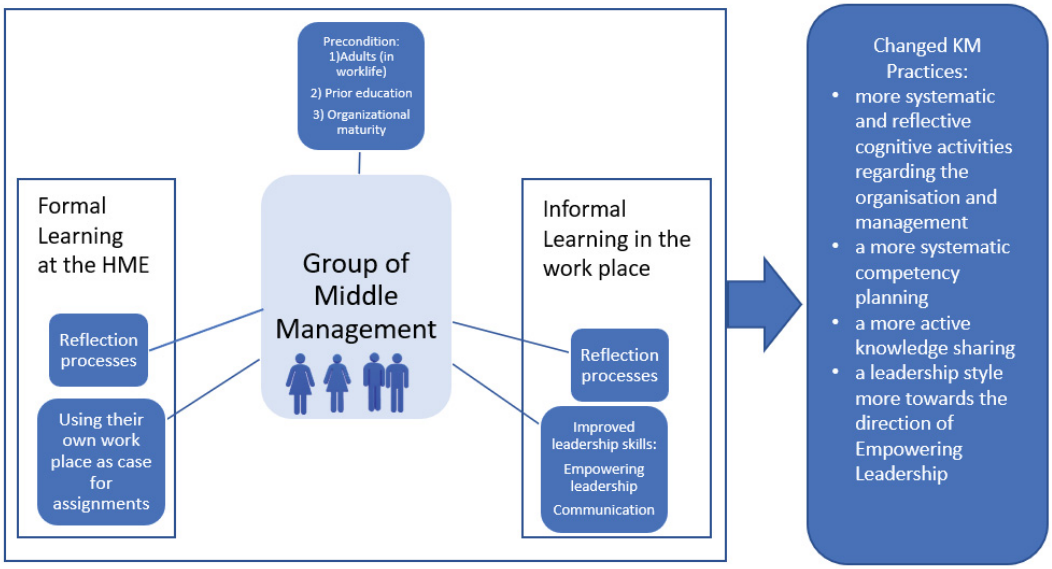

Figure 4: The different aspects of the relevance of HMP: Changed KM practices, processes and outcomes

One major advantage our students have is that they have experienced a prior education; hence, they know how to transform this into an advantage for the organization (Filstad, 2016).

Leadership development, communication and empowerment are key factors that meet the requirements for them, and what is expected of them. The expectations from the managers above are about executing leadership at the middle management level. They have the skills, the abilities and the position, and it is expected of them. The students also have expectations regarding being able to utilize their education (Eccles, 2014, Wigfield and Eccles, 2000), which will bring them into a better position to apply the wanted changes. Through their behaviour as managers, they execute systematic KM practices.

The degree of relevance of the education seems to correlate with how one has used the case examples from the students' work-life and practice in the study through assignments and reflection exercises. In turn, this will be carried on as a reflection and learning praxis back in the organization.

Within the scope of changed KM practices, we can also derive that they have developed innovativeness. We find that because of the way the students execute their new management skills, the subordinates have been subjects of autonomy that support innovativeness. What can be compared to empowered leadership (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015) implies supporting the subordinates to develop autonomy, and the sense of being empowered, both of which are necessary in order to develop innovativeness (Støren and Arnesen, 2016, OECD, 2010).

6. Conclusion

We have provided evidence showing how HMP is a relevant formal adult education programme for middle managers and their organizations in Norwegian healthcare. On the individual level, the former students (middle management) have shown a high motivation and assertiveness regarding their education. According to their managers and subordinates, their job execution has changed, although in different ways. Through establishing systematic reflective processes and competency planning, they have developed a management practice in line with Empowered Leadership (Amundsen and Martinsen, 2014, Amundsen and Martinsen, 2015). This has further opened the opportunities for the subordinates to actively engage and contribute toward a higher level of innovativeness within the organization (Støren and Arnesen, 2016).

We find that the education has had relevance at the individual and organizational levels, as it has increased the knowledge on the competence planning and knowledge sharing of middle management, and enabled the change of KM practices within the organization. This counts for two out of three of the managers who have changed their attitude towards their subordinates, and are more conscious about involving and empowering their staff.

To generalize our findings beyond the scope of HMP and the healthcare sector, we may assume that educational programmes, such as the HMP, are of considerable relevance for the work-life provided that distinguishes individual qualities, skills and competences at work, which are also appreciated and in demand. More specifically, we need to remind the reader that our results and conclusions depend on the following analytical preconditions that shape the empirical evidence, and therefore the findings of this study:

1. The students attending the HMP programme are adults, and the learning situation is adapted to theories of adult learning, such as grounding the education on the students´ own work-life situations.
2. The students have a previous vocational formal higher education.
3. The organization is receptive and adaptive to changes, and in particular to public sector innovations (high level of maturity regarding changes).

The relevance is experienced through the interconnectedness, such as, e.g., reflection processes between the formal and informal learning processes, which is displayed through the development and change of KM practices.

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The Peculiarities of the Organizational Learning of Clinicians and their Causes

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Abstract: The perception of knowledge management has evolved over the last several decades from managing the information to the involvement of employees in knowledge work – in particular, in the OL processes. However, research literature describes various obstacles for organizational learning in hospitals, related to both, the context of the organization's activities, as well as the clash between the professional autonomy of the clinicians and the bureaucratic requirements regulating the work done by the clinicians. This paper looks into the peculiarities of the OL of clinicians occurring on both individual and collective levels and examines the causes that condition these peculiarities. The paper opens with an introduction, wherein the research problem is substantiated, the aim of the research and the conceptual positions are provided, the logical structure of the research is outlined. The literature review conducted in the second chapter reveals the essence of organizational learning, explains the significance of individual and collective learning for OL. Next, the researchers delve into the work done by clinicians as professionals in the context of OL. The steps taken allow substantiating the three levels of clinicians' involvement in the OL processes – individual, group/department and organization-as-a-whole. A thorough review of the theoretical background created the conditions for the empirical investigation into the organizational learning of clinicians. The research has been conducted in a small hospital in Lithuania. Highly selective sampling suggests that the data on the OL of the clinicians acquired during the research, and a detailed description of its relation to the context provides reliable insights into various aspects of the organizational learning of clinicians. The conclusions also raise questions that require further investigation, suggest health care administrators and clinicians consider collective efforts to create better quality organizational knowledge that would enable healthcare institutions to cope with continuously emerging ill-structured problems.

1. Introduction

Contemporary healthcare organizations face many challenges due to unpredictability and complexity of human lives, as well as rapidly changing technologies. For organizations, some challenges ultimately result in new possibilities, whereas for others they create new problems. How effectively an organization responds to these challenges has a great deal to do with the extent to which they can muster a whole-of-organization response, which relies on knowledge, strategic insights and readiness to accept the changes. The present COVID-19 pandemic clearly indicates that healthcare institutions, particularly hospitals, need to be knowledge-based if they are to develop innovative solutions to emerging complex problems. Of prime importance to the organization is a smart knowledge management system that does not impose an additional bureaucratic burden but enables organizational learning (OL) processes. OL empowers members of an organization to individually and collectively create knowledge necessary for the organization's activities.

Organizational learning in healthcare institutions continues to attract the attention of researchers; generally speaking greater attention is paid to aspects of creating and introducing innovations for enhancing the performance of such institutions (Hilton, Flanzer, Cartwright, and Fletcher, 2002; Reay and Germann, 2008; Çınar and Eren, 2015). However, OL has potential when it comes to patient safety (Edwards, 2017), as well as crisis management (Smith and Elliott, 2007). Some of the most recent contributions (e.g. Hartmann and Hartmann, 2020) are directly related to organizational learning in light of the COVID-19 crisis.

Beyond doubt is the role of OL in empowering healthcare institutions, particularly hospitals, to solve complex problems, however, some international studies in this field indicate problems related to the contexts of OL. Some of these problems may discourage clinicians from becoming involved in the process of organizational learning (Doolin, 2004). For instance, this kind of 'kickback' from the clinicians could be induced by the use of OL for the introduction of bureaucratic requirements, which clinicians perceive as restricting their professional autonomy (Waring and Currie, 2009). On the other hand, the bottom-up, non-formal organizational learning approach that stresses the employees' initiative, has been increasingly investigated by researchers (Wei and Yuan, 2011; Brandi and Iannone, 2015; Chou and Ramser, 2019). In light of the controversies mentioned above,

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there is a need to closely examine the organizational learning of clinicians, which should be considered as an inseparable part of their professional work, as well as an activity necessary for the successful functioning of a hospital as such.

This paper investigates the peculiarities of individual and collective organizational learning of clinicians, as well as the causes that condition these peculiarities.

The conceptual framework of the research comprised the following: 1) Organizational learning creates the conditions for developing the knowledge necessary for organizations to overcome the emerging challenges (Nonaka, 1994), however, it is not the organization as such that learns, but rather the people in the organization (Cannon and Edmondson, 2005). 2) Organizational learning occurs at the individual and collective levels (Chiva, Ghauri, and Alegre, 2014).

The research comprised the following: a) *analysis of scholarly literature* has been employed to theoretically investigate the organizational learning of the clinicians and the possible peculiarities of OL in hospitals, considering the professional aspects of clinicians' work, b) *semi-structured interviews* were used to investigate the manifestation of the organizational learning of clinicians in a particular hospital, whereas c) *document analysis* has been conducted to investigate the hospital as an organization and the aspects of its work that are relevant to establish a relationship between organizational learning and the work of clinicians as professionals.

The article consists of an introduction and two main parts, the first of which is related to the theoretical investigation of the essence of OL in research literature, whereas the second is the empirical investigation of the peculiarities of clinicians' OL in the selected hospital. Conclusions and recommendations are presented as a result of the analysis and discussion of the findings from the investigation.

2. The organizational learning of clinicians

The chapter opens with an introduction of the essence of organizational learning, which is vital for delving into the problem addressed in this article. Next, the place of OL in the knowledge management system is highlighted, revealing the OL not only as a knowledge management process but also as a social process. The latter becomes especially significant when it comes to professional's work in an organization. Therefore, the work of clinicians as professionals in the context of organizational learning is explored further. This will reveal the structure of clinicians' organizational learning in the hospital at the end of the chapter.

2.1 The essence of organizational learning

Organizations learn to promote the continuous development of innovations. The only question, according to Basten and Haamann (2018) is whether learning is conducted systematically. Chiva, Ghauri, and Alegre (2014) suggest the following definition for such organizational learning: "*it (OL) is the process through which organizations change or modify their mental models, rules, processes or knowledge, maintaining or improving their performance*" (Chiva, Ghauri, and Alegre, 2014, p. 689). While the fact that organizations develop knowledge necessary for their activities seems to be generally accepted (Argote and Miron-Spektor, 2011; Senge, 2014; Wu and Chen, 2014; etc.), the levels on which such learning occurs seems to still be a matter of some debate (Schultz, 2017; di Stefano et al., 2017; Örtenblad, 2018; Pedler and Burgoyne, 2017). And yet, as a rule, research literature on OL distinguishes between collective and individual learning that occurs in organizations. In this paper, the authors agree with such structure of learning, and assume the perspective suggested by, among others Sessa and London (2015) and Namada (2018), whereby collective learning is further broken down into group learning and learning on the level of the organization-as-a-whole (Sessa & London, 2015), or what Namada (2018) refers to as institutional learning.

Several models that allow deeper understanding of OL can be found in literature (e.g. Argote and Miron-Spektor, 2011; Basten and Haamann, 2018**).** However**,** one of the best-known models for development of organizational knowledge has been created by Nonaka (1994). The model (known as SECI) explains creation of organizational knowledge through conversion of tacit and explicit knowledge of the members within an organization.

Nonaka (1994) has proposed that such knowledge conversion within an organization takes place through four stages: socialization, externalization, combination and internalization. In the *Socialization* stage tacit knowledge is created through the interaction (verbal or non-verbal) of individuals within a small group (by 'being together').

Individuals create what Nonaka (ibid) referred to as shared experience, which is characterised by particular contexts and emotions related to these experiences. Nonaka (ibid) refers to the next stage as *Externalization*. During this stage, explicit group knowledge is constructed from tacit knowledge through discussions among individuals. However, an organization usually consists of several or more groups (divisions). Therefore, the next stage, known as *Combination*, sees the collective explicit knowledge (usually - the goals of the organization, rules, other standards) at the level of the organization (as a whole) constructed through agreements among the groups that use this knowledge in their activities. Combination refers to the process of combining bodies of explicit knowledge through social processes (e.g. meetings). In the next stage, which Nonaka (ibid) calls *Internalization*, this generated knowledge at the organizational level is disseminated among the employees of the organization and their groups: various communication channels, as well as training, are used. In this stage, the explicit knowledge is exercised and embedded into the routines of the individuals within the organization, and over time it becomes tacit knowledge of the individuals. Thus, organizational learning takes place by creating the organizational knowledge that an organization needs to implement change, create and implement innovations, or otherwise cope with challenges. For this purpose, the organization continually sets new goals and objectives. Especially important in this respect is for employees involved in such a process of organizational knowledge creation to understand what the organization is striving for and be determined to participate in achieving these goals/objectives. Naturally, OL occupies an essential place among knowledge management processes, and organizational leaders seek to enable this organizational knowledge creation by directing it in the direction needed by the organization. However, at the same time, OL is a social process. So, what is the relationship of this process to knowledge management?

2.2 Organizational learning in the knowledge management system

Knowledge management can be viewed from several perspectives. The technological approach emphasizes the technical and technological aspects of knowledge management (Grant and Shahsavarani, 2006). The social approach, on the other hand, emphasizes human, cultural, organizational aspects (Hlupic, Pouloudi, and Rzevski, 2002). The socio-technical approach combines the social and technical aspects of knowledge management (Coakes, 2002). If in its inception, knowledge management was based only on the technical approach, then later a consensus was reached that people and their knowledge are central for knowledge management, because various value creation processes in an organization largely depend on them. After evaluating the work of researchers based on various perspectives, Šajeva contributed by substantiating the Conceptual model of the socio-technical knowledge management system (Šajeva, 2010). At the heart of this system, is the integral process of knowledge management, which "includes a set of practices or activities that are initializing in an organization in order to identify, acquire, create, store, disseminate, and apply knowledge" (Šajeva, 2010, p. 771). However, these processes are not self-serving; they work in conjunction with other organizational processes, thus creating organization's value. Šajeva (ibid) identifies five main components of a knowledge management system: strategic leadership, organizational infrastructure, knowledge culture, organizational learning and technological infrastructure. The first four, according to Šajeva (ibid, p. 771), interact with each other, forming the "social context" of the system, which in turn is related to the technological infrastructure that also serves all knowledge management processes.

Based on this conceptual model, it is not difficult to notice the particular place of organizational learning in the knowledge management system. Organizational knowledge creation is directly related to organizational learning (Nonaka, 1994) because OL results in the creation of organizational knowledge. Thus, OL has a dual role in the knowledge management system: organizational learning is an integral part of the knowledge management process, and at the same time, OL is placed within the social context of the system.

Šajeva (ibid) interprets organizational learning in terms of individual and collective learning processes. The researcher recognizes that these processes can take place in formal and non-formal structures. However, Šajeva does not delve into the various aspects of such formal and non-formal organizational learning that takes place at the individual and collective levels, and its relationship to strategic leadership, organizational infrastructure, and knowledge culture. Investigation of these aspects may raise many questions, especially taking into account the profile of the organization, which is directly linked to the nature of the professional's work.

When it comes to hospitals as organizations and the nature of the work of its main staff - clinicians as professionals - many questions arise: what is more important in terms of building organizational knowledge - the organizational learning of clinicians at the individual or collective level? Which processes of clinicians' collective learning are emphasized - in a group, e.g. a department, or the whole organization, i.e. in the hospital?

When does formal organizational learning (within formal structures) take place? How does leadership influence it? Finally, when does non-formal organizational learning tend to take place? How and why does it occur?

2.3 Work done by clinicians as professionals in the context of organizational learning

Hospitals are classified as professional work organizations, because the medical profession requires a high level of special education usually linked with solving complex problems necessitating a great deal of responsibility. Typically, professional work is highly autonomous. However, work done by a clinician is related to the safety of the patient, which imposes strict bureaucratic requirements for the competence of the clinician. The combination of the autonomy and bureaucratization of professional work through procedural guidelines 'can be seen as blurring, or hybridizing, bureaucratic and professional ways of organizing work' (Waring and Currie, 2009, p.756). Easterby-Smith and Lyles (2005) pointed out that knowledge management was employed to increase organizational safety. Such management of knowledge is centralized, and organizational learning is managed to mitigate clinical risk. As reported by Waring and Currie (2009), clinicians either try to get away with or oppose the discussed type of management. Thus, a phenomenon of alternative organizational learning emerges to avoid limitations imposed by a similar policy. For example, Doolin (2004) examined the instance of how clinicians sought to avoid implementing an information management system in a hospital in New Zealand. The chances of coping with emerging challenges and problems at different levels were assessed even more pessimistically by other researchers. Some stated that the members of healthcare organizations 'did not even think organizationally' (Ramanujam and Rousseau, 2006, p. 822). Mylopoulos and Scardamalia (2008) explored the possibility of licensed clinicians for innovating their practices and sharing the created innovations with their colleagues (the situation directly points to the practice of organizational learning) in a hospital in Toronto. Unfortunately, the authors (ibid) found that clinicians did not think about innovation because they had too many responsibilities in the first place.

However, some researchers are optimistic about the organizational learning of clinicians. Based on a large-scale survey and empirical research conducted by other authors (Canada and USA), Ratnapalan and Ulerik (2014) discovered that organizational learning was essential for patient safety for the quality of work done by clinicians. Although OL is crucial to hospitals, albeit more often, leaders play a pivotal role in enabling OL in small professional groups. Noteworthy in this respect is the role of non-formal leaders. Alas and Vadi (2003) studied the staff of six Estonian hospitals and established that organizational culture had an impact on their organizational learning in a rather particular way. The OL of those having less than five years of professional experience was influenced by task orientation, whereas the focus on relationships influenced the OL of the staff counting more than five years of work experience in the hospital. Babaeinesami and Ghasemi (2020) disclosed that improved communication between hospital staff had a positive impact on organizational learning.

Hence, it is vital to determine for what purposes organizational learning is practised and what factors determine it. One aspect is clear – the organizational learning of clinicians has to occur in harmony with safety requirements and work done by professionals thus respecting their autonomy-based responsible decisions. OL enables innovation in and the development of hospital as a whole, including departments, clinician groups and every professional individually.

2.4 The structure of clinicians' organizational learning

In terms of organizational learning, three dimensions of performance should be distinguished when it comes to clinicians as hospital employees: a) clinician as an individual professional; b) clinician as a member of his/her department or group; c) clinician as a member at the organization as a whole. The current chapter delves into this structure

2.4.1 Learning at the individual level

Clinician learning that meets the goals and objectives of the hospital as an organization focused on a specific professional is considered organizational learning that takes place at the individual level. In order to successfully cope with all the roles assigned by the organization, a clinician is expected to continually develop competence in response to ever-changing work conditions and emerging challenges. A considerable amount of the knowledge gained by clinicians is enshrined in specific regulations as necessary to have, it is evident that their work done is case-specific, because each situation may require a different approach. Therefore, learning is obligatory and mandatory for clinicians. As for the individual level, clinicians ensure the quality of their performance through reading professional literature, attending seminars/conferences, internships, generating

new ideas from personal experience or discussions with colleagues, learning new clinical procedures, recent rules, the standards of specific training or documents, i.e. through formal and non-formal learning methods.

However, it is essential to highlight the role of the patient in the learning process. Kurtz (2002) provided that clinicians actively learned about interactions with patients in the workplace by asking, discussing and reflecting together with patients. Communication with a patient plays a particularly important role in making a diagnosis. Boelen (1997) stated that every clinician had to be able to convey relevant knowledge to the patient to make him/her actively involved in the continuation of clinical treatment (clinicians can hardly devote a large portion of time to a single patient). Therefore, on-the-job learning is a particularly important form of constructing clinician's knowledge to ensure continuous professional development.

Hence, clinicians consistently maintain their knowledge at the level commensurate with the development of scientific knowledge in medicine and requirements set by the hospital and enable them to cope with patient treatment challenges through formal and non-formal learning that is in line with the goals and objectives of the hospital as an organization focused on the specific clinician.

2.4.2 Learning at the group level

Every clinician belongs to a specific group, team or department (e.g. department of cardiology, internal medicine, neurology, etc.) and applies personal knowledge in order to demonstrate collective knowledge within an appropriate team etc. The shared information is frequently important for both a certain unit / team and the entire organization.

Many authors (Carroll and Edmondson, 2002; Brigley, Johnson, Bird, and Young, 2006; Lonka, 2009; Littlejoh, Malligan, and Margaryan, 2011; Mann, 2011; Večkienė, Brunevičiūtė, Saulelienė, and Ražanauskaitė, 2011, etc.) investigated teamwork and collective knowledge in the healthcare sector and argued that teamwork was essential. Lonka (2009) suggested that medicine was an area of the highly structured ways of communication and embraced roles, norms, rules and tools. Clinicians are accustomed to the specific ways of thinking and acting. However, the clinicians belonging to a particular department need to focus on their professional activities, need to adapt and understand how to transform their activities through collaborating, creating artefacts and tools with the other members of the unit (colleagues) and how to make the shared experience effective in achieving better results. Thus, a group of clinicians is a kind of a community of practice the primary purpose of which is to implement treatment in relevant areas. Eidintaitė (2012), noticed that to achieve a common goal, the members of the community of practice had to be linked to common information share flows overlapping the sense of identity, values and behaviour in the department.

The clinicians working in a unit and having the same or very similar treatment orientation need to work as a team the members of which permanently learn from each other and share knowledge of the treatment process and communication instances with patients. This type of learning forms group knowledge generally referred to as collective and can either be tacit or explicit. Tacit knowledge is formed within the process of socialization (Nonaka, 1994) when the clinicians of a small group (often in pairs) communicate by being engaged in activities together ('being together'). The knowledge acquired by the explicit group is constructed through externalization (Nonaka, 1994). The latter stage often occurs when clinicians address a specific problem as a group such as selecting treatment tactics to address a disease complication in a particular patient. The solution to this problem is expressed in a verbal form and is the result of the externalization process. Organizational learning at the group level is usually conditioned by interpersonal communication. If the creation of collective knowledge always remains non-formal in the socialization process, then, at the externalization stage, group knowledge can be created in two ways: for example, formal organizational learning may take place during a meeting in the department.

Meanwhile, a joint decision (collective organizational knowledge) made by the clinicians who rushed to the ER to administer emergency care for a person with severe atypical trauma shall emerge from non-formal organizational learning. Although aimed at the task of the organization (e.g. to provide efficient help to a patient with an atypical complex trauma), such organizational learning is accepted non-formal and takes place spontaneously without any particular management action (e.g. head of the department does not convene a clinicians meeting and they meet on individual initiative).

Bandura (1977) noticed the human knowledge acquired individually was always subjective, and therefore learning at the collective level made the gained knowledge more objective. Johnson (2007) argued that at each stage of organizational knowledge development (and thus at the stage of externalization), the individual learning of each member of the organization could take place as a side effect. However, collective learning plays a particularly important role in medical work that is practically implemented by clinicians several times a day.

2.4.3 Learning at the level of the organization (as-a-whole)

Carroll and Edmondson (2002) investigated clinician learning at the level of the organization and suggested that achieving systematic organizational learning required a comprehensive combination of values, skills and structures in a healthcare organization. The organizations that value long-term rather than short-term performance and care about other aspects (performance, safety, quality, environment) and stakeholders (employees, customers, suppliers, community, society) recognize the need for learning and reserve time for it.

First of all, it is related to the clinician understanding his/her personal place, role and relationship with the organization. Therefore, the clinician belonging to a particular department or organization should first understand the mission and goals of that organization. Managers should also be concerned with the following questions: Are the mission and goals of the organization understood by all employees of the organization? Are purposeful efforts made aimed at ensuring the implementation of the mission, goals and values? What is the relationship of the mission of the hospital to treatment and research activities?

The vision of the organization also depends on knowledge about aspirations the organization will envision in the future. The mission and vision are linked to the philosophy of the organization and are accepted as the core values of the organization. These values dictate the ethics of work done by clinicians and are the basis of treatment and relationships with patients and colleagues. Thus, it is imperative for the organization to seek collaboration among clinicians on organizational issues (e.g. can be addressed in meetings) or to make sure that every clinician knows the procedures and rules at the organizational level. Meanwhile, clinicians can contribute meaningfully to the overall knowledge of the organization, its well-being and the development of core values by expanding or acquiring new knowledge (reading documents, attending general meetings, participating in training).

Thus, the organizational learning of clinicians at the level of the organization-as-a-whole takes place: a) by discussing various treatment, organizational issues together with other hospital staff during formal meetings (combination stage, developing explicit organizational knowledge, see Nonaka's (1994) SECI model); b) by adopting new organizational procedures, rules and standards during training or reading documents (internalization stage, as stated in Nonaka (1994) for converting explicit into tacit knowledge in-use).

However, the questions if organizational learning as discussed in this chapter is possible in light of lack of the organizational thinking of clinicians in general (Ramanujam, Rousseau, 2006) and whether the pressure to adopt organizational learning reduces their operational autonomy (Waring, Currie, 2009) require empirical investigation.

3. Empirical research in the organizational learning of Clinicians

The current chapter is aimed at investigating the peculiarities of the OL of clinicians. The chapter starts with an outline of research methodology. The results of empirical investigation into the OL of the clinicians working in one of the hospitals in Lithuania are provided next.

3.1 Empirical research methodology

The aim of empirical research is to reveal the peculiarities of the organizational learning of clinicians working in the hospital through the process of proving or disproving the following ***propositions***:

1. The organizational learning of clinicians occurs at three levels: individual, group and organization-as-a-whole. However, OL at the level of the organization-as-a-whole is the least pronounced.
2. The organizational learning of clinicians is available in formal and non-formal contexts: at the individual level, OL is rather non-formal, at the group level, OL is both formal and non-formal and at the organizational level, OL is formal.

3. Clinicians tend to mostly focus on their work as professionals, and therefore use organizational learning to ensure the quality of their work done rather than being actively involved in the hospital as the members of the organization.

Methodological approach: a) the process of organizational learning and its peculiarities are revealed and can be studied by interviewing clinicians, the direct participants of this process; b) organizational learning can be reliably explored in the same organizational context, i.e. one hospital; c) it is appropriate to study the OL of the clinicians working at different departments, as more reliable evidence can be expected if similar trends emerge when comparing the findings; d) qualitative descriptive study has been selected to explore organizational learning, which is suitable for conducting investigations into sensitive phenomena (Vaismoradi, Turunen, and Bondas, 2013) represented by OL.

Methods: a) OL is a process that encounters difficulties in identification, and therefore researchers have opted for a semi-structured interview method; the questions were asked following the logic of OL parameters highlighted in the first chapter of the article; b) the method of document analysis was selected for exploring the hospital as the context for OL; c) the acquired data have been processed applying descriptive content analysis.

Sampling. An empirical study of the organizational learning of clinicians was conducted in one of regional state hospitals located in a small town counting less than 10 thousand inhabitants in Lithuania, an EU Member State. A medical institution with a solid history was selected for investigation. The preferred institution has been known for the exceptional performance of clinicians and contributed to improvements in the quality of medical services nation-wide. A regional hospital has been chosen deliberately. The contention was that greater coherence between bureaucratic demands made by managers to ensure safety and the interest of clinicians as professionals and their autonomy could be expected in a small rather than in a sizeable enterprise-type hospital. At the time of the study, the hospital employed around 300 staff members. The investigated hospital has ten departments, a modern clinical laboratory and an operating theatre. Over a thousand surgeries are performed here annually. The hospital uses modern minimally invasive surgical techniques. Pursuant to the documents of the hospital, all staff are directed to improving their skills, implementing new, modern treatment methods, ensuring high-quality medical care and nursing for both the residents of the region and Lithuania. The strategic plan of the organization expresses the position of the hospital as an organization, which facilitates staff learning/development. The hospital has an information management system (created from technical but not social point of view) which is connected the national health care information system.

The organizational learning of clinicians required selecting at least two departments for investigating and cross-examining the data obtained from different departments. The clinicians of four departments, including a) Department of Internal Medicine (hereinafter referred to as Department A) - 3 informants, all exceeding 25 years of work experience; b) Department of Surgical Traumatology (B) - 5 informants (three surgeons and two traumatologists), one having 20 years, the rest – exceeding 25 years of work experience; c) Department of Paediatrics (C) - 2 informants, both exceeding 30 years of work experience; d) Department of Neurological Diseases (D) - 2 informants, both exceeding 30 years of work experience, agreed to participate in the research.

Research ethics. For selecting the hospital and interviewees, the principles such as voluntary participation and information about the aim, methods and benefits of the conducted research were followed and gave them a sense of involvement (Cohen et al., 2002). The following aspects were considered during the interview and presentation of data on the interviews and details of the hospital: a) protection from harm (physical or psychological); b) respect for individual dignity; c) right to self-determination; right to privacy; d) protection of confidentiality (Sullivan and Forrester et al. 2018).

Research design did not employ any potentially harmful approaches, and therefore neither physical nor mental well-being of the informants was threatened. Each informant was treated with dignity. Participation in the interviews was absolutely voluntary, and the questions were designed in a way not to impose the answers on the informants. Hence, the self-determination principle was satisfied. The fact that the title of the hospital and the names of the informants were not disclosed in either stages of the research ensured their privacy and confidentiality.

3.2 Organizational learning of clinicians in the investigated departments: similarities and differences

The section presents and analyses the data on clinicians' formal and non-formal OL at the individual, group, and organization-as-a-whole levels. The stages of organizational learning (socialization, externalization, combination, and internalization) as recognized by physicians are explored by analysing the interview data.

3.2.1 Formal and non-formal organizational learning recognized by clinicians at the individual, group and organization's levels

Before delving into the organizational learning of clinicians at different levels of the organization, it should be noted that they tend to equate the mission of the hospital with the purpose of the organization, and view it as a constant assurance of high-quality healthcare services. Hence, the investigated clinicians identify the activities of the organization with professional activities, but are indifferent to their participation in the organizational activities of the hospital, attributing it to the work of managers.

Therefore, the observations of all informants about OL concern only the aspects of clinicians' work.

3.3 Organizational learning at the individual level

A typical expression: "... in fact, we don't have time to go to seminars often because then there's no one to work with. There are only three of us, there is a lot of work, we would really like to go somewhere more often to expand our knowledge, but there is no one to work for. ... The seminars are mainly to be attended for the revalidation of the license - 144 hours in 5 years ..." (Department A Clinician A). Feedback from patients is essential for the accumulation of physicians' experience: "... I gain a lot of knowledge from working with patients, receiving some inpatient treatment or outpatient feedback, so it is possible to assess the suitability of my treatment tactics, thus gaining more experience." (Department B Clinician B). Clinicians noted that individual reflection is characteristic of them. It has been observed that people who work longer reflect less: "I think about my activities often, but not as often as I did 20 years ago ..." (Department B Clinician D), "I used to reflect a lot, now not so often, maybe because I am confident in my work, perhaps because the experience is already extensive" (Department B, Clinician E). Clinicians from departments C and D pay special attention to reflection: "I analyze my actions all the time, this is how much knowledge is developed, sometimes I even notice that I have more knowledge than I think" (Department C clinician A). However, most often in their answers, clinicians emphasized the integral benefits of both professional literature and learning from experience: "... if I learned only from practice, there would be many mistakes. Literature is the basic knowledge on which to accumulate that experience" (Department D Clinician B). This clinician also distinguished the benefits of such integrated experience: "I learn from my work and personal life experience."

It has been observed that it is often difficult to distinguish between individual and group learning in physicians' OL activities: "...we communicate among ourselves all the time, I tell my colleagues about the interesting cases I have, we analyse these cases, even surf the Internet for information together... the patients themselves contribute somewhat to creating new knowledge, but I rather learn more from colleagues than from patients ..." (Department A Clinician B).

Table 1: Formal and non-formal organizational learning of clinicians in particular departments at individual, group and organization's levels (bolded – indicated as significant by informants, underlined – indicated as the most significant by informants)

Organizational learning		**Departments**			
		A	**B**	**C**	**D**
Individual level	Formal	Seminars and other training	Seminars and other training	Seminars and other training	Seminars and other training
	non-formal	**From colleagues' experience, <u>studying literature</u>**	**From colleagues' experience, <u>studying literature</u>**	**<u>Through reflection on own experience</u> and from colleagues' experience, studying literature**	**<u>Through reflection on own experience</u> and from colleagues' experience, studying literature**
Group level	Formal	Department meetings	Department meetings	Department meetings	Department meetings; **councils with colleagues**

Organizational learning		Departments			
		A	B	C	D
					from the department, ward rounds
	non-formal	**Sharing experience with the colleagues from the department while being in the same room; collaborating with them while solving treatment problems;**	**Sharing experience with the colleagues from the department while being in the same room; collaborating with them while solving treatment problems;**	**Sharing experience with the colleagues from the department while being in the same room; collaborating with them while solving treatment problems;**	**Sharing experience with the colleagues from the department while being in the same room; collaborating with them as well as clinicians from other departments while solving treatment problems**
Organization's level	Formal	Inter-departmental meetings for treatment questions; Meetings of hospital employees, during which managers present new standards.	Meetings of hospital employees, during which managers present new standards.	Meetings of hospital employees, during which managers present new standards.	Councils with clinicians from other departments; Meetings of hospital employees, during which managers present new standards.
	non-formal	Joint decision-making through non-formal consultations between several departments	Joint decision-making through non-formal consultations between several departments	Joint decision-making through non-formal consultations between several departments	Joint decision-making through non-formal consultations between several departments

3.4 Organizational Learning of Clinicians at the Group Level

Interview data suggest (see Table 1) that the clinicians of all four departments practice non-formal learning at the group level, which usually takes place while solving treatment problems encountered by the department. Similar situations involve all clinicians of the department into discussions: they share knowledge obtained from professional literature and gain valuable experience, which reflects common activity of the group, energizes into a common solution to the problem thus resulting in a collective knowledge of the group, helps with making further decisions and assists in creating rules for joint work. It should be noted that the faced situation takes place at the non-formal level typical of a small hospital department counting only a few clinicians: *"We don't need any meetings, we discuss things "on the run", and when it is only the two of us, it's easy"* (Department C, Clinician A).

3.5 Organizational Learning of Clinicians at the Organization Level

Examining the organizational learning of clinicians at the level of the organization-as-a-whole (see Table 1) demonstrates that clinicians are not engaged in the organizational activities of the hospital. Although some informants state that, for instance, *"... as a doctor, I understand the aim of our institution, the purpose of our hospital, during meetings the administration stresses the basic regulations of our hospital"* (Department A, Clinician C), however, upon closer inspection, it becomes clear that this approach is more superficial rather than a deeper understanding of the management and organizational activities of the hospital. This does not mean that informants neglect a close relationship between the employee and work organization. Instead, they realize it considering professional responsibilities: *"Maybe these issues need to be understood from a clinician's perspective and then applied to the entire organization. The organization wants to survive, so we have to try our best to do our job"* (Department C, Clinician B). Clinician D from department B: *"... what other mission might it be if not to provide the best quality treatment? And that means the same goals."* Nevertheless, the capability of

the respondents to pinpoint the vision and goals of the institution they work for remains unclear. In consequence, it appears very much questionable if they were familiar with the documents regulating activities within the organization, but no doubt they were well aware of the requirements set for their jobs they had learned individually and further discussed with colleagues at the group level. It has been observed that clinicians do not feel generating any managerial knowledge at the organization level. Nonetheless, they are actively involved in developing the knowledge vital for treating specific patients during short briefings (including physicians from the entire hospital). A few informants mentioned councils where more complex treatment cases were discussed with the physicians from several departments. They attributed organizational learning to the level of the organization-as-a-whole. However, this study faces difficulty in clearly distinguishing between the boundaries of formal and non-formal functioning, which is apparently due to the atmosphere of non-formal communication prevalent in the investigated organization. The respondents agree that democracy prevails in their organization, employees are free to express their views to the administration, no internal communication problems are detected, it is easy to agree with colleagues and the work environment is tolerant enough. Department A, Clinician B: "*It is not ideally tolerant, but when I know how it is in other organizations, I can say that our organization is tolerant. People sympathize with you, people respect you, and people help you here*."

Thus, it can be observed that the OL of clinicians at the level of the organization-as-a-whole is limited to the point where such joint efforts are related to the direct responsibilities of clinicians rather than to the activities of the entire organization (e.g. communicating with the external environment, participating in national and international projects, etc.).

The peculiarities of the OL of clinicians working at the investigated hospital are discussed in this chapter and will hopefully be revealed by delving into OL stages. The next chapter looks for consistency in OL activities done by clinicians.

3.5.1 Stages of Organizational Learning as revealed by Clinicians

The analysis of the organizational learning of clinicians in light of the SECI model (Nonaka, 1994) shows that the peculiarities of developing organizational knowledge in each of the stages described by this model in the investigated hospital are relatively distinct. The emergence of collective tacit knowledge characterizes the socialization stage that occurs as a result of employees sharing the same space and working together for a prolonged time (from tacit to tacit knowledge). In this case, favourable relations between employees, the conditions of 'being together' created by the organization and the history of joint work have a significant influence. Thus, this is typical of the investigated departments: the clinicians of each unit stated there was a friendly atmosphere, constant communication and collaboration between colleagues. The created conditions included a well-equipped common room for clinicians with a furnished zone for non-formal communication. For example, Department B has as many as three offices, including a surgeon's office, a traumatologist office and a shared rest area. The reflections of clinicians only confirm the effectiveness of the socialization stage: "*we understand each other without words"* (Department A, Clinician C).

The externalization stage describes group learning activities where organizational knowledge is created at the department level (from tacit to explicit knowledge). The success of the socialization stage also influences the success of the externalization stage that is also affected by other factors. It has been observed that OL at the group level occurs similarly in all four investigated departments. The peculiarities of the researched departments in this stage are well described by the summary of the answers provided by the clinicians from Department A: the meetings of the clinicians of this department are not formal, and therefore it is not necessary to create additional conditions for gatherings. As for work in a shared office, clinicians make decisions important for the department in a non-formal manner. In the cases the general meetings of the department are organized (including all staff of Department A, special facilities are provided (conference room is allocated), but clinicians do not single out meetings as essential for organizational learning at the group level.

This enables a discussion of the non-formally occurring externalization stage. Department A, Clinician C: "*We have an unwritten rule: when we meet in the morning, we have coffee together and discuss all the issues that concern us, and at the same time reflect on what is well, what is wrong, what needs changing <...> We have been working together for many years, and somehow we have never had problems related to collective problem-solving ... Some documents define the responsibilities of each doctor, we know it ourselves, and we manage to make those decisions constructively, without any conflicts*." Thus, non-formal conversations replace formal departmental meetings, except for the cases when clinicians attend meetings with other ward staff (chief nurse

and nurses). Discussions with colleagues within the department are identified as one of the most critical elements of work and the learning process. In light of discussions, the most important decisions for the department are made, and clinicians improve their performance. It should also be mentioned that physicians recognize the benefits of patient feedback for collective learning processes; the obtained information is identified as one of the main factors in accumulating group experience.

The combination stage relies on collective learning that takes place at the level of the organization-as-a-whole. The solutions that require joint effort to develop new norms, rules, conventional ways of work and similar knowledge are created during this stage. As for the hospital, general knowledge applies to:

1. the development of the hospital as an organization (managers do not make managerial decisions without consultation with departments);
2. collective decision-making involving all (or several) departments in the case they have relevant competence (hospital management may be absent), e.g. for hospital admission in the case of poly (multiple) diagnoses;
3. treatment purposes of the necessity for making decisions on specific patients by consultation with the clinicians of different areas. While the organizational learning of types (a) and (b) is of formal nature, type (c) may be formal and non-formal, subject to the situation.

The responses of the clinicians working in the studied departments revealed that a collective knowledge of type (a) was not constructed. The investigated hospital has been managed more in a public administration approach, and therefore is considered more 'by the book' than a modern type of management.

The problems of developing a collective knowledge of type (b) lie in joint decisions that have to be made involving all (or several) departments. The clinicians of Unit A noted it was difficult to agree with other departments of the organization. Negotiations sometimes lead to conflicts, which is due to the fact that the administration does not clearly define the authority of each unit in the cases when inpatients have several diseases treated by different departments. No procedure describes in what case the patient is admitted to which department and how other departments interact with that department. On the other hand, it paves the way for creative collective solutions proposed by professionals.

Clinicians also mentioned the daily briefings (c) of all departments discussing treatment problems. The importance of the briefings was emphasized by the clinicians from Department A as a significant aspect of learning. This is highly important for this particular department, as work done by internal medicine physicians covers an unusually broad diagnostic profile. The learning environment of the briefings is interdisciplinary, because it involves the clinicians of different areas, which is an essential feature of this environment. The democratic environment of the organization was found to be an important aspect of interdepartmental meetings. The organizational learning of type (c) can also be non-formal: "*We work closely with the Department of Internal Medicine, we consult each other, as we predominantly treat elderly patients, who have more than one disease, and sometimes several dozen diseases. In the admissions department, we also consult patients together with other specialists*." (Department D, clinician B).

The interviewees also mentioned formal general meetings of the members of the entire organization (held every Tuesday, bringing together all clinicians, chief nurses, chief nurse practitioners and the administration). The joint meetings of all departments usually take place because the administration of the organization has to report specific updates to clinicians. During formal meetings, information is channelled and should be absorbed rather than created. The opinions of clinicians are not always deemed necessary. The meetings resemble the initial processes of information provision and assimilation that take place in the internalization stage.

The internalization stage covers the newly created or otherwise acquired formal knowledge disseminated to other employees. As discussed in the previous chapters, the results of the conducted research show that the administration usually disseminates information in general meetings, and in exceptional cases (for instance, information is especially important) – utilizes telecommunications. However, the presented information is not created jointly by the members of the organization and often embraces laws, regulations and rules governing work done by the hospital and its employees. As noted from the interviews, physicians absorb and act on the information governing their work. However, within this framework, they are also able to express themselves as professionals who need to make non-standard decisions.

3.6 Discussion of findings

The results of the empirical research allow to prove or to correct the previously formulated propositions:

- The organizational learning of clinicians occurs at three levels: individual, group and organization-as-a-whole. However, OL at the level of the organization-as-a-whole is the least pronounced (proved);
- Organizational learning of clinicians occurs mostly non-formally, the formal OL (directly influenced by the management) is random. The acquired data does not support the proposition. The organizational learning of clinicians occurs in formal and non-formal contexts: at the individual level, OL is rather non-formal, at the group level, OL is both formal and non-formal and at the organizational level, OL is formal;
- Clinicians tend to mostly focus on their work as professionals, and therefore use organizational learning to ensure the quality of their work rather than being actively involved in the hospital as the members of the organization (proved).

However, some aspects of the obtained results require more in-depth insight, and therefore a more comprehensive discussion. First, it is necessary to recall some circumstances of the study conducted in a small hospital. As reported by Malhotra (2009), arbitrarily the hospital having less than 200 beds may be classified to be small. The respondents unanimously claimed that the climate of their organization was 'warm', which assisted in maintaining good relations among each other as well as with the management. It should also be noted that all studied clinicians exceeded 20 years of experience (some as long as 40 years) and were, therefore, older people. Alas and Vadi (2003) found, the organizational learning of older employees is driven by relationships rather than by goal orientation. Thus, the size of the hospital, the prevailing atmosphere and, most importantly, the self-identification of clinicians as professionals working in their small departments allow considering an organizational culture of a communal type (high sociability and high solidarity) (Rashid, Sambasivan, and Rahman, 2004), most evident in the activities of departments.

Departments are the place where clinicians do their main work. In this way, it is quite understandable why clinicians stress organizational learning at the individual and group/unit level. The individual level of learning is especially important for an employee who perceives him/herself as a professional. Learning at the group level is essential for a professional frequently facing extraordinary situations that require non-structured solutions and a high level of responsibility for them. This determines the need to develop organizational knowledge in a group of professionals that usually works in a department of the hospital. The focus is shifted on relationships rather than is goal-oriented. At the same time, the perception of oneself as a professional encourage non-formal organizational learning at the above introduced levels.

It is also necessary to delve into the following findings:

1. For comparing the significance of two OL levels, clinicians consider OL to be more significant at the group rather than at the individual level. This may be linked to the need for particularly complex decisions at the unit/group level. The quality of these decisions and a reduction in risk levels are achieved through the knowledge generated by the collective mind (Brown and Harris, 2015);
2. clinicians indicated that individual OL facilitated organizational learning at the group level. However, researchers also notice the opposite effect: collective OL is seen as the primary product, and OL at the individual level is accepted as the by-product of the former (Nonaka, 1994; Lee and Roth, 2007). The peculiarity about OL practised by clinicians in the investigated hospital may be explained by the fact that, first of all, the clinician, as a professional, seeks to make his/her own decision even in the most complex cases. Therefore, clinicians address personal experience, knowledge and seek additional information and synergy to develop a new solution leading to recent knowledge. This is individual work directed by the sense of responsibility for making a decision and frequently remains at the level of 'individual contemplation' if a group is asked for help. Hence, it is thought that collective knowledge is created by a group, and generated solutions are usually more objective compared to those produced at the individual level (Bandura, 1977). However, a group does not create knowledge on a "tabula rasa" (blank board) basis; each member of the group offers personal experience and gained knowledge. As a result, OL at the individual level influences OL at the group level.

Nonetheless, it should be considered that the surveyed clinicians stressed the necessity for involving different departments to make the most complicated decision. Thus, in such cases, interdisciplinary and intergroup learning takes place at the organization-as-a-whole level. This type of OL also tends to be predominantly non-formal but is less frequent than OL at the group level.

In light of socialisation, externalisation, combination and internalisation processes, the organisational learning of clinicians has revealed several findings reinforcing the previously discussed aspects. First, the processes of socialisation and externalisation were manifested in all investigated departments. The process of socialisation is influenced by an extensive history of working together, favourable relations and physical conditions created for communication. The presence of all necessary conditions, particularly the ones enumerated above, was emphasised by all physicians. If socialisation is essentially a non-formal OL process, externalisation is usually described as formal OL taking place in group meetings.

Meanwhile, in the case of the studied departments, externalisation was mostly manifested through the creation of group knowledge in non-formal gatherings. Even when formal department meetings were to take place, they involuntarily turned into a non-formal conversation about solving problems. Such propensity for non-formal organisational learning while being together seems to be conditioned by situational circumstances and the psychological safety of clinicians acquired while being together. It is the influence of psychological safety perceived by employees on organisational learning disclosed by Lyman, Ethington, King, Jacobs, and Lundeen, (2017) in the study of nursing work. The combination stage is also characterised by peculiarities distinct from those discussed by Nonaka (1994). At this level, OL was hardly found to enhance knowledge necessary for the development of the organisation, but rather interdisciplinary knowledge acquired by different departments of the hospital in the process of solving complex treatment problems. Noteworthy is the fact that OL is successful at this stage of non-formal problem-solving. However, when formalised complex decisions need to be made, conflicts sometimes arise due to the absence or lack of deeper knowledge of work regulations. Meanwhile, the internalisation stage of OL has been found to be limited to the dissemination of information by hospital management to the staff. The gained information is usually related to governing work done by clinicians and other hospital staff with the hope it will be absorbed and followed. In other words, this stage is not linked to disseminating the knowledge generated by the members of the organisation at the combination stage within the organisation.

In light of the SECI model, the peculiarities of OL stages of clinicians at the investigated hospital revealed some aspects of knowledge management. The fact that non-formal OL was found to be predominant meant that the social context of the system was mostly pronounced in the investigated hospital in terms of the knowledge management system (Šajeva, 2010). This context is characterized by a resilient relationship based on OL and knowledge culture conditioned by the personal relationships between the members of the organization as well as the identity of clinicians as professionals and the values of work done by a medical professional. Strategic leadership is aimed at enabling and maintaining such type of relationships (developing democratic relations within the organization, creating excellent jobs in departments, ensuring group activities, etc.) as well as ensuring the quality of medical work. However, there are no indications that the knowledge management system takes place within this organization (the information management system is a technical one but is not based on the social perspective). Indeed, it was not the aim of elucidating the introduced situation, but investigation into OL would have made it possible in part to detect some of the features of that system if they existed.

The absence of the knowledge management system in the investigated hospital does not mean that clinicians, as some authors argue, 'do not even think organizationally' (Ramanujam and Rousseau, 2006, p. 822). However, the fact that non-formal OL prevails over formal OL demonstrates that physicians successfully think organizationally when creating individual and collective knowledge required for ensuring professional work done by physicians at the hospital. However, above all, clinicians lack organizational thinking when it comes to undertaking OL processes to achieve organizational development goals. Thus, clinicians emphasize their work as professionals and accept bureaucratic requirements for work done as a natural necessity defining limits on the clinicians' activities. This provides security for all three entities – the patient, the clinician and the hospital. As the obtained data suggest, the hospital has a successful hybrid approach to the professional and bureaucratic ways of organizing work (Waring and Currie, 2009). It is crucial that hospital management uses the hybrid approach to implementing the standards and rules developed by senior officials (ministries, etc.) and help professionals working for this organization, especially clinicians, to stay involved in their professional work and in developing their organization. After all, as Galleli, Fischer, Ferreira Marques, Melo, and Pilli, 2018) proposed it is not the organization that learns, but its people.

4. Conclusions

Theoretical analysis of the scholarly literature on knowledge management, organizational learning in healthcare institutions and clinicians as professionals has revealed the following:

- Firstly, the clinician's organizational learning would seem to occur with the creation of organizational knowledge at individual, group/department, or at whole-of-organization level. OL is considered formal if initiated and/or influenced by management. Non-formal OL is at the initiative of the clinicians themselves, specifically in course of their professional duties;
- Formal and non-formal OL may be manifested differently, and at different stages of its development. Non-formal OL takes place at the socialization stage, which is characterized by the creation of tacit knowledge, i.e. "being" and/or "acting" together. Both formal and non-formal OL can also occur at the stages of externalization, combination and internalization, depending on the circumstances, i.e. the context;
- A number of factors determine the nature and peculiarities of OL that takes place in a hospital such as organizational culture, managerial leadership, workplace relationships, and staff competence, etc. Specific factors are also at work, including: a functioning knowledge management system; the autonomy of the clinician as someone responsible for human health and life; administrative/bureaucratic requirements for the clinician's work; the confluence/conflict/coherence between the autonomy of the clinician; and the administrative/bureaucratic requirements for ensuring patient safety and minimising risk, etc.

With regard to the experience of clinicians in the small hospital chosen for this study, the research also found that:

- OL takes place even if the hospital does not have a knowledge management system. The OL experience of the physician occurs through a non-formal bottom-up approach at the three levels –individual, group (department) and the organization-as-a-whole. Here, the main factors influencing OL is a sound working relationship with colleagues, as well as a sense of professionalism when treating patients, especially those with complex medical problems. Moreover, although OL occurs predominantly at the group level, OL at the individual level is also meaningful, because not only does it have a direct impact on the enhancement of clinical competence, but it also positively impacts OL at the group level. OL is manifested least at the level of the organization-as-a-whole;
- Although organizational learning occurs predominantly at the group level, organizational learning at the individual level is also meaningful: not only does it have a direct impact on the enhancement of clinicians' competence, but it also has a positive effect on organizational learning at the group level. OL is manifested the least at the level of organization-as-a-whole.
- The identity of the clinician as a professional determines non-formal organizational learning on a bottom-up basis. Clinicians associate their activities with a great deal of responsibility for the work they perform. However, they also value their professional autonomy and this determines that they conduct their OL (at all three levels) in order to ensure high-quality treatment. Hence, rather than expend time and effort on developing the hospital as an organization per se, clinicians assign this function to management;
- Physicians take a hybrid approach, making professional decisions within the limits set by administrative requirements. Thus, to reduce risk while solving complex treatment problems, physicians are highly likely to experience non-formal OL at the group (department) level; such OL prevails in the investigated organization;
- Non-formal OL also prevails at the level of the organization-as-a-whole, especially when complex treatment problems are being resolved, since various departments (and clinicians representing these departments) are involved in the development of organizational knowledge. For the same reason, formal OL sometimes takes place, which can often result in managerial solutions applied to complex problems affecting the work of several departments. Indeed, the existence of administrative rules detailing the principles for the interoperability of the hospital's departments is one factor that ensures a smooth, formal OL at the level of the whole organization. Clinicians view such regulations positively, and do not regard them as limiting their professional autonomy; on the contrary, they feel somewhat constrained in their absence.

The research results condition some practical suggestions for hospital managers, as well as clinicians. First, it is essential for hospitals to create conditions that foster the collaboration culture among clinicians, especially when it comes to inter-departmental consultations for solving complex treatment issues. It is equally important to strike a perfect balance between the administrative requirements for clinicians' work and the opportunities for them to make non-standard creative decisions. Organizational knowledge is always created by people; hence, it is particularly important for clinicians to not only be immersed in their professional activities, but also get involved in the activities of the hospital as an organization.

The study of one hospital explores the peculiarities of the organizational learning of clinicians, and while this may be a limited context, the aforementioned hospital is typical of its kind. Repeating such a study in similar hospitals, as well as investigating the peculiarities of clinicians' OL in large hospitals, would be useful. This research raised the following questions which deserve further consideration: what factors might clinicians find useful to better focus on their work as professionals, and also participate in the development of their organization? What should be the role of the hospital management in encouraging clinicians' OL and other forms of organizational involvement, such as the development and implementation of a knowledge management system, the development of knowledge, and treatment culture, etc? To answer these questions, collaboration between researchers and practitioners, which typically include hospital administrators and clinicians, is required.

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Knowledge Creation on Edible Vaccines

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Abstract: In this paper we delve into the health sector and explore the way vaccines might change in the near future. As new challenges emerge, health professionals are faced with the need for innovative, effective answers to many issues, such as health-threatening viruses and diseases, that grow increasingly more complex, calling for new and practical solutions. Building on this framework, we have decided to address edible vaccines - a completely innovative and simpler way to administer vaccines - not only to understand if it is viewed in a favorable light but also to find out how the knowledge regarding these vaccines can be increased. After a thorough literature review, it became clear that the information about edible vaccines is not evident and easy to access. We then decided to apply a mixed methodology in our study, based on 15 interviews, in person and by email, addressing healthcare professionals, with the intent of gathering their experience and possible knowledge about vaccines. Additionally, an online survey was created and answered by 370 concerned citizens, in order to ascertain their knowledge and receptiveness to this matter. Hereupon, we concluded that, in both samples, there was very limited knowledge about these vaccines, it becoming obvious how important it is to transmit qualified information through accessible means, such as newscasts, scientific papers and magazines, health centers and hospitals, among others. Regarding the level of acceptance by the public in general, our results show that this innovation is dependent on its correct disclosure and propagation, since it is of great advantage and benefit for society. In sum, how the relevant knowledge (including proof of effectiveness) is managed and disseminated will be key.

Keywords: traditional vaccines, edible vaccines, field work, mixed methodology, Genetically modified organisms, GMOs

1. Introduction

In the range of management, innovation is the key that makes possible the delivery of new solutions. "Companies started to notice the increase in the demand for innovation to the point that it was too significant to be ignored and could not be left to chance" (Lajoso et al., 2020, p.437). Indeed, the pioneer in strategy research stated that "companies achieve competitive advantage through acts of innovation" (Porter, 1990, p.75). Innovation needs to be focused and face the needs of consumers (Carvalho, Roberto dos Reis and Beatriz Cavalcante, 2011). These same authors stand for the fact that every organization, regardless of the sector of activity, region or country, ought to prepare to innovate systematically and continuously. This brings us to the subject-matter, innovation regarding the health sector.

Over the past few decades, the health sector has gained increasing importance and appreciation (Ordeanu, 2018). As a consequence, there has been an attempt to invest in areas that allow for a greater development of this sector, namely in the area of technology (The Organisation for Economic Co-operation and Development, 2019).

At the same time, and despite the increase in average life expectancy that has been observed in recent years, the context in which we currently live, more distanced from nature and more sedentary, has led to the increasing importance of the health issue (Frumkin et al., 2017). Merchant (2013) claims sitting is the smoking of our generation, due to the fact that even most jobs require us to stay in front of a computer all day. On average, 9.3 hours a day are spent sitting, compared to only 7.7 hours spent sleeping.

The changes that have taken place in terms of lifestyle have also led to new health challenges, namely the emergence of new diseases resulting from a constantly changing world (Whitesides, 2014). A recent example of

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this change is the latest version of the COVID-19 virus, which has become a true global pandemic, and has reinforced the importance of vaccination (Gates, 2020).

In the face of this event of worldwide repercussions, the need for vaccination has been increasingly discussed, and, to date, there is still no vaccine available (Del Rio and Malani, 2020; Patlas, 2020).

Tragedies such as the one that the world is currently experiencing demonstrate the need to invest in the creation and development of vaccines and reinforce the fact that it is essential to have laboratories capable of responding to these events (Gates, 2020).

With this article we try to present what is a new reality in the field of vaccination: edible vaccines. Through this theme, we compare this new reality with the traditional vaccines already known, explaining the different advantages and disadvantages associated with each one. Our aim is also to perceive the public opinion on the matter, the opinion of the people linked to the health area regarding these two types of vaccines and possible recommendations in the development of edible vaccines.

2. Literature Review

2.1 Knowledge Management and Creation

In order to innovate, it becomes essential to apply all current knowledge to create new knowledge. Thus, knowledge management (KM), meaning the complex process of identification, attainment, development, distribution, use and protection of precious knowledge, presents itself as an important competitive advantage for companies (Melo, 2019). According to Choi and Lee (2002), if a company fails to continuously create knowledge, the unavoidable result is poor performance.

In the competitive environment of companies, knowledge management is a central element in order to guarantee that a company performs an analysis of knowledge and its competences (North and Kumta, 2018). A company's knowledge is constantly being complemented with new knowledge, resulting from the company's actions and the pressure from the external environment (Grimsdottir and Edvardsson, 2018).

As mentioned by Little and Deokar (2016), due to the importance of knowledge management, organizations are now progressively trying to understand the knowledge assets within the company. Consequently, organizations have been aiming to align their knowledge management strategies with their business process management (Little and Deokar, 2016).

Different factors will condition the knowledge creation and management process (Abubakar, et al., 2019). The authors point out some of these factors, such as organizational structure, organizational culture and information technology.

However, the knowledge creation and management process has been greatly altered by the arrival of the digital age, offering new opportunities and creating new challenges, leading to the consequent emergence of new business models (North and Kumta, 2018).

2.2 Traditional vaccines

2.2.1 Vaccines: concept

Vaccines emerged, and are still used today, with the ultimate goal of reducing the existence of some diseases and, as a consequence, reducing mortality rates (Subtil and Vieira, 2011). For this reason, it is considered one of the most effective ways to promote public health (Fonseca et al., 2018; Orensteina and Ahmedb, 2017; Pinto, Matta and Da-Cruz, 2011), leading to a 73% decrease in mortality worldwide, preventing between 2 and 3 million deaths annually (World Health Organization, 2019; Santos and Hespanhol, 2013). Consequently, vaccination is considered to be a strategic action for different countries, being essential for national security (Ordeanu, 2018).

Vaccines consist of preparations created through a specific process and composed by a set of substances that, when administered, cause the body to create immunity against some agents (Pinto, Matta and Da-Cruz, 2011; Santos and Hespanhol, 2013). Most vaccines are administered through syringes and needles (Pinto, Matta and Da-Cruz, 2011), this task being mainly performed by nurses (Subtil and Vieira, 2011).

2.2.2 Vaccines: advantages and disadvantages

The efficiency of a vaccine, when it comes to the prevention of diseases, can depend on both the vaccine being effective and its correct administration to individuals who are able to respond to it (Orenstein et al., 1985).

With this in mind, and according to a generally divided opinion by the public when it comes to this matter, we can all agree that vaccines have advantages and disadvantages. After a careful literature review on this matter, we realized that the benefits that come from this prevention system are, clearly, bigger than its disadvantages and challenges. Perhaps they only need to be updated and be more innovative.

When it comes to the so-called advantages, "vaccination is the most successful application of immunological principles to human health" (Khan, 2013, p. 26). The same author keeps on substantiating that these diseases represent a major global problem. This can only mean that their prevention must be a public health priority. Live vaccines have been administered to hundreds of millions of individuals during the past decade, and their results are extremely reliable and efficient (Melnick, 1978).

On the other hand, the possibility of adverse effects (Schatzmayr, 2003) along with the fact that injections can be painful and, in some cases, expensive, involving needles, syringes and a trained professional to administer them (Pinto, Matta and Da-Cruz, 2011), appear to be some of the disadvantages that can be found when analyzing the traditional vaccines. Additionally, there are several diseases caused by pathogens, which enter our body through a mucous surface, such as the gastro-intestinal or the respiratory tract. This means an injection is not the standard way of entry of most pathogens, as vaccination is meant for (Pinto, Matta and Da-Cruz, 2011).

2.2.3 Vaccines: "The (not) global acceptance"

In Portugal, the National Vaccination Program came into force in 1965, providing free vaccines to the population (Subtil and Vieira, 2011; Fonseca et al., 2018). Since 2015, vaccines against thirteen different diseases have been included in this plan (Fonseca et al., 2018).

Despite the importance of vaccination, there is still a part of the world population that is not vaccinated, including millions of children (Fonseca et al., 2018; World Health Organization, 2019). This occurs mainly in countries considered to be less developed (World Health Organization, 2019). At the same time, hesitation regarding vaccination, which is largely due to the spread of wrong information, has been increasing (Orensteina and Ahmedb, 2017; Pinto, 2018).

In Portugal, vaccination is not mandatory, so the individual, or his, or her, representative, can refuse it (Santos and Hespanhol, 2013; Fonseca et al, 2018; Pinto, 2018). However, vaccination is strongly recommended by health professionals (Pinto, 2018).

Despite this possibility, a study carried out in Portugal in 2018 concluded that there is a low number of parents refusing vaccination (Fonseca *et al*, 2018; Pinto, 2018). According to recent studies, the Portuguese regions with the lowest occurrence of vaccination are the Autonomous Regions (Machado et al., 2019).

The main problem with refusing vaccination is that it is an individual act and, as such, only leads to the protection of an entire community when each individual chooses to do so, thereby reducing the spread of disease in that population (Orensteina and Ahmedb, 2017). According to the same authors, this community protection ends up leading people who are not vaccinated, or cases in which the body did not have the expected reaction to the vaccine, to be protected indirectly, so greater vaccination coverage is essential.

2.2.4 Genetically Modified Organisms

Consumers are nowadays undoubtedly interested in the food they consume, particularly with regard to its origin and components (Wunderlich and Gatto, 2015). As a matter of science, genetically modified foods have become a controversial issue due to their potential impact on the human diet, existing patterns of food production, genetic diversity and the environment (McInerney, Bird and Nucci, 2004).

Genetically modified organisms (GMOs) are organisms in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination (Sun, 2018). GMOs are then used for various reasons, some of which are improved resistance of crops to herbicide, insects (Wunderlich and Gatto,

2015) and diseases. At the same time, with this resource men can use natural resources in a more efficient way and it also contributes to the conservation of natural habitats, since with GMOs we can make the most of the existing arable land, preserving nearby habitats (Bayer, 2019). In 2018, the GMOs which were most cultivated worldwide were essentially cotton, soybeans and corn (Québec, 2020).

Public debate regarding the receptivity of GMOs in food production focuses on the controversy that originates in weighing over the risks to human health and the environment. The response of consumers to these risks can be volatile, as was seen in some protest actions in Europe (Nelson, 2001), where there is a low rate of adoption of genetically modified products and there is a greater inclination to pay for foods without GMOs than there is in America (Wunderlich and Gatto, 2015).

Despite all this, since the commercialization of GMOs began, the areas destined for its cultivation have undergone a notable evolution. According to Québec (2020), the United States is, currently, the leading producer of genetically modified foods, contributing with 73.1 million hectares of land and 40% of the global total cultivation of GMOs. The same author refers that this country is followed by Brazil (42.2 million hectares), Argentina (24.3 million hectares), India (11.6 million hectares) and Canada (11.6 million hectares). Many of the countries that contribute to the global production of Genetically Modified Organisms are industrial countries (Québec, 2020). At the same time, it is possible to affirm that most of these countries are developing countries that resort to GMOs because of their need to increase harvests (Wunderlich and Gatto, 2015).

Despite the apprehension displayed by public opinion, the World Health Organization endorses the idea: “GM foods currently available on the international market have passed safety assessments and are not likely to present risks for human health. In addition, no effects on human health have been shown as a result of the consumption of such foods by the general population.” (World Health Organization, 2014).

2.3 Edible vaccines

2.3.1 Edible vaccines concept, advantages and ethical aspects

Vaccines have been the most powerful “weapon” against viruses and infections, preventing the risk of contagion and defending us from our many diseases (Criscuolo et al., 2019). However, as mentioned before, the traditional vaccines, despite having several advantages, have a number of important disadvantages. The goal, today, is to find innovative vaccines that are easier to administer and can target numerous pathogens in their various stages (Gunasekaran and Gothandam, 2020). In order to achieve this, edible vaccines are seen as the solution to the problems caused by traditional vaccines (Criscuolo et al., 2019). These new vaccines are cheaper than the old ones: they do not go through the purification and downstream process (Gunasekaran and Gothandam, 2020). Besides this, the same authors refer that they can be easy to preserve and to “scale up”. This is undeniably impressive, considering that, as mentioned in the article, “the entire population of China could be vaccinated by producing edible vaccines in just 40 hectares of land” (Gunasekaran and Gothandam, 2020). According to the same authors, edible vaccines enable the organism to have an immunologic response merely by the consumption of genetically modified plants, including vegetables and fruits. This response is achieved through the activation of the mucosal immune response system (MIS), which is our first line of defense, since that is exactly where human pathogens start their infection (Gunasekaran and Gothandam, 2020).

Researchers introduce the desired gene into the plant, so it can produce the corresponding protein (Criscuolo et al., 2019; Gunasekaran and Gothandam, 2020). This transformation is carried out by a specific nonpathogenic virus or bacteria (Gunasekaran and Gothandam, 2020). There is almost no chance of contamination of humans by plants´ pathogens since these are harmless to them (Criscuolo et al., 2019; Gunasekaran and Gothandam, 2020).

According to Gunasekaran and Gothandam (2020), edible vaccines can be produced in several plants or vegetables such as the banana, tobacco, potato, tomato, rice, etc. There are still edible algal vaccines that are very similar to the plant ones, however, they are easier to modify genetically (Gunasekaran and Gothandam, 2020).

These vaccines can contribute to the reduction of many diseases in underdeveloped countries where the conservation, transportation and administration of traditional vaccines is very complicated (Kurup and Thomas, 2019).

Although they have many advantages, there is a problem related with "global approval" (Kurup and Thomas, 2019). It is crucial for people to be aware that edible vaccines are cost effective, efficient and safe, when compared with traditional vaccines (Kurup and Thomas, 2019). The same authors, already mentioned, believe that they can even guarantee a better prevention from diseases. Regulatory and GMP (Good Manufacturing Practice) requirements have to be the ethical base to develop these types of vaccines (Kurup and Thomas, 2019).

2.3.2 Reasons to select certain plants

Hence, certain targeted plants will be the ones chosen for their being appropriate to be modified genetically, in order to develop edible vaccines (Gunasekaran and Gothandam, 2020). The same authors argue that research and development are important tools to optimize the transformation process.

Furthermore, the plants chosen for this process have to be preserved for a long time without degrading, which is the case of cereals such as rice (Gunasekaran and Gothandam, 2020). Then, they need to have a short growth time, such as tobacco and tomato (Gunasekaran and Gothandam, 2020). Thereby, according to the same authors, fruits from trees cannot be used, since they grow slowly and take a long time to mature.

In fact, plants have a lot of advantages, but the most important one is that they can be easily mass produced, using various techniques (Gunasekaran and Gothandam, 2020). Micropropagation can be very important after the transformation process since plants grow in controlled conditions - "The technique of plant tissue culture is used for growing isolated plant cells, tissues and organs under axenic conditions (in vitro) to regenerate and propagate entire plants" (Iliev et al., 2010, p. 1).

2.3.3 Related studies

The "National Institute of Allergy and Infectious Diseases approved edible vaccine for its remarkable effect of immunogenicity in 1998". (Kurup and Thomas, 2019, p. 80)

Research associated with edible vaccines has been carried out since the end of the twentieth century (Kurup and Thomas, 2019). The same authors refer that, nowadays, in order to overcome certain fiscal restrictions, such as logistics and the transportation of traditional vaccines, edible ones are being developed to prevent malaria by the identification of three antigens. According to the same authors, measles and hepatitis B edible vaccines are being created too. With regard to measles, according to Kurup and Thomas (2019), there are studies proving the presence of IgA antibodies in faecal samples of the animals that consumed these types of vaccines with the corresponding protein. Transgenic carrot and potato are the plants chosen for measles and hepatitis B edible vaccines, respectively (Kurup and Thomas, 2019). The same authors refer that even autoimmune diseases, such as type 1 diabetes, can be controlled by the consumption of a potato that contains insulin, maintaining insulin levels established. There are still many other edible vaccines developed against E.coli infection, through transgenic corn; cholera infection, by transgenic potatoes; and norovirus infection, using potato and tobacco as candidate plants (Kurup and Thomas, 2019).

3. Methodology

Our research study and research questions aim to address whether edible vaccines are both an acceptable and viable healthcare option. Are they viewed in a favourable light? What are the advantages and disadvantages of this innovative procedure? How might knowledge regarding these vaccines be increased?

Vaccines are vital to human survival, as the current pandemic regarding the new disease Covid-19 shows (World Health Organization, 2020). The resolution of the current global crisis is seen to be dependent on the creation of a vaccine to thus create immunity to the virus in the worldwide population. This is but one application of vaccines.

Hence, a literature review was performed, in order to gain crucial knowledge about the topic and its current implications worldwide, using the research databases available, such as Scopus and Academia, for example. We opted for the use of specific keywords, such as "vaccine", "administration", "edible", "advantages", "disadvantages" and "GMO". These words were used to reach some of the most important scientific evidence in this article.

The future of technological innovation is not as unpredictable as it might appear, but when the development of new technologies takes place, it can never be certain how the market will respond to it (Schilling, 2017).

Therefore, we decided to perform a mixed methodology study, considering it was very important for this study to have the perspective of both the people who administer the vaccines (involving 15 interviews), and the people who receive them (a total of 370 answers were gathered). The first group it was intended would provide an in-depth perspective on the subject of vaccines and edible vaccines, in particular; this data would be complemented by the "meanings and findings" of the survey (Saunders et al., 2016, p.173). The objective was that "mixed methods may allow for a greater diversity of views to inform and be reflected in the study" (Saunders et al., 2016, p.173). Greater confidence in our conclusions would result (Saunders et al., 2016), from using a mixed method, which is "an increasingly used and accepted approach to conducting business research and in the social sciences more generally" (Bryman and Bell, 2015, p.643).

Hence, an interview script was prepared for healthcare professionals experienced in the administration of vaccines, based on the previous literature review, and will be explained later in this segment of the article.

During the process of this study, a total of 25 nurses and pharmacists were contacted with the intent of gathering their experience and possible knowledge about vaccines, their implementation in the general population and this innovative method: edible vaccines. However, only 15 of those professionals replied to our contact and were interviewed, some in person and some by email (due to the COVID-19 pandemic we are facing at the time of writing) with an average duration of 15 minutes each, resulting in the conclusions laid out in sub-section 4.2 of this article.

In addition, as mentioned above, a survey was prepared and put out to the public, mainly via social media, meaning Facebook and identical platforms, since we wanted to get the largest and more diverse range of answers that we could. A total of 370 answers were received. This sample is mainly a convenience sample, since it was obtained from sharing it with the authors' acquaintances. This kind of sample, substantially more available to the researcher, is often used in exploratory studies, as it presents itself as a very useful tool for research, in order to reach a larger population and gather sufficient answers to enable interesting conclusions (Bryman and Bell, 2015). These authors suggest that valid conclusions can be based on an even sequence between a quantitative and qualitative framework (mixed method), as followed herein.

However, an effort was made in order to make the quantitative study as probabilistic as we could: once we were short on responses from the older age group, the survey was placed on Facebook groups for citizens over 65 years old. Additionally, a small percentage of individuals that are not a part of the convenience sample, were contacted personally, in cafes and other public areas, with the purpose of gaining a more diverse response rate.

In this survey, we decided to ask for basic personal information from our respondents, such as their age, gender, occupation, geographic location and the dimension of the place of residence (1-5), so that we could later analyse the data and find possible links between the groups of people and their answers. We then proceeded with a question referring to their knowledge about GMO (Genetically Modified Organisms) (6) and inquired whether the respondents were in favor or against them (7). These answers would be the premise from which we would be able to determine if knowing about the GMO could influence the participants' opinions on edible vaccines, as well as understand if their opinion on these organisms was biased by the media coverage of the issue or not (8). The following question present in this survey inquired about the possible need of more reliable information on the subject (9). We then chose to question the respondents regarding their view on traditional vaccines (10) hoping to understand if they had somehow struggled with their administration (11) or to highlight some of its various disadvantages (12). The last three questions of our survey aimed to perceive the participants' view on edible vaccines. First of all, we tried to understand if they had, in fact, understood what edible vaccines were (13). We took the liberty of providing a brief description of them in the beginning of our survey, in order to avoid misunderstandings or answers lacking foundation. We also inquired about their willingness to take edible vaccines (14). Our last question aimed to gather suggestions for a better understanding of this new way of vaccine administration (15), since we believe it might be one of the main obstacles in their implementation.

As we previously mentioned, in order to expand this exploratory study to health professionals and get their opinions on this subject, we developed an interview script based on essential issues related to edible vaccines and their work experience. Summing a total of six questions, we first chose to ask the respondents about their age, gender, occupation and where they worked. Then, we inquired the participants about their knowledge or unawareness regarding edible vaccines (1). If the answer to this question was a negative one, we proceeded in explaining this new concept. The following question aimed to understand whether the respondents were in

favor or against them (2), as well as the motive for their decision. We then asked about the main struggles they found in administering traditional vaccines (3); whether they found these new vaccines would be easily accepted by the general public (4); what did they consider a main obstacle in the implementation of the edible vaccines (5). Our last question was related to their opinion or suggestion regarding this possibility in the future (6).

4. Results and discussion

As mentioned above, after our research and field work, we received 370 and 15 answers from our online survey and our interviews, respectively.

4.1 Online survey

Concerning the answers from our survey, we noticed that 77,8% of them were from people aged less than or equal to 24 years old, followed by 10,8% from 25-45 year olds, 9,2% from 46-65 year olds and 2,2% from people older than 65. It was expectable to have more answers from young people, since our methodology focused on social networks, like Facebook. However, this is important since this type of vaccine will probably be implemented in the future, so it is crucial to know their opinion about this innovation. Therefore, students were our most representative percentage, 75,1%, considering the question regarding the respondents' occupation. As we can see in figure 1 most of our responses were also answered by women, representing a total of 77%.

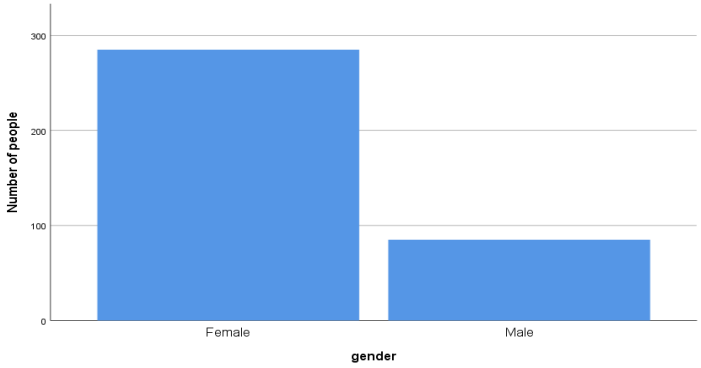

Figure 1: Frequency of people by gender - Q2

Observing figure 2, we can notice that we received answers from all of the geographic localizations in Portugal: the North (45%), Center (47,6%), South (4,6%) and the Islands (1,9%). We even gathered data from distinct types of locations: cities (55,1%), towns (21,9%) and villages (23%).

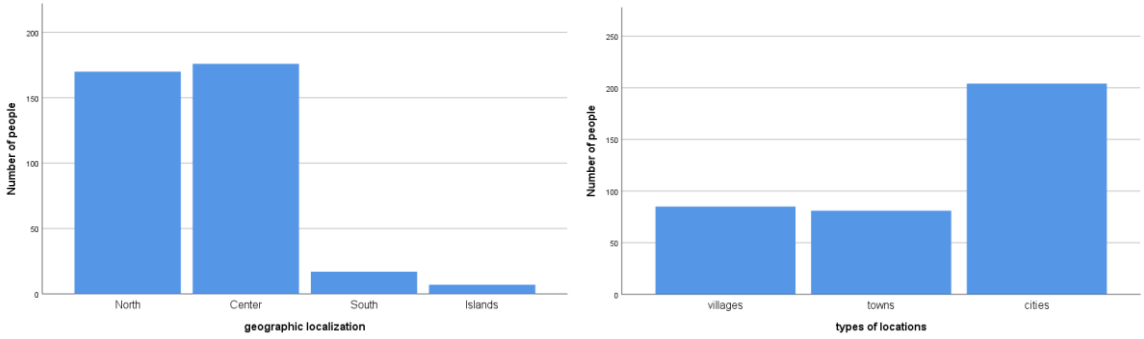

Figure 2: Frequency of people by geographic localization-Q4- (left) and types of locations-Q5- (right)

After analysing what kind of people answered our online survey, it is extremely important to see the answers to the questions related to our main theme: edible vaccines. Thus, regarding our sixth question about the knowledge acquired about GMOs (Genetically Modified Organisms), the answers were dispersed. Around 10,5% of them chose the answer number 5, having advanced knowledge about it. Then 29,5% answered the number 4; 33,8% the number 3; 11,9% the number 2 and 14,3% the number 1, having a limited knowledge about GMOs.

Although more than 50% of them know something about GMOs, it is extremely necessary to improve that knowledge. In order to confirm their existing knowledge, we elaborate questions 7, 8 and 9, related to their position on the matter: for or against GMOs; the influence of information in taking that position and the need for the transmission of more information, respectively. In fact, we obtained a percentage of 73,5% in favor and

26,5% against GMOs (table 1). Hence, in order to understand if this decision is influenced by social media or any other information that was transmitted, we got answers to question 7: 45,9% answered "No"; 37,3% "Perhaps" and 15,4% "Yes". We also had 1,4% saying that they had never heard anything about it (table 1).

Table 1: Intersection of values of question 7 and 8

Number of people						
		Q8				Total
		Yes	No	Perhaps	Never heard anything about GMOs	
Q7	In favor	40	130	101	1	272
	Against	17	40	38	3	98
Total		57	170	139	4	370

Therefore, we can see that 47,8% of the sample that are in favor of GMOs, think that the information transmitted by the media had no influence in the decision made in question 7.

Concerning answers to question 9, we can conclude that it is crucial to transmit more information about GMOs, since these can play a relevant part in our future. In fact, 98,1% of the sample agree with that, and one person even said that "[better information] should be transmitted, instead of the demonization that is led by the media and in social networks".

Regarding data collected from question 10 (regarding views on traditional vaccines), we noticed that 95,8% of the sample are in favor of traditional vaccines. According to the answers of question 11 (to understand if they had somehow struggled with traditional vaccine administration), this happened, despite 44,9% of them having answered the question with option number 1, having no experience of any difficulty when administering that type of vaccine. 20% of the respondents opted for number 2; 18,6% number 3, having some difficulty; 5,9% number 4 and 10,5% number 5, having a huge difficulty (figure 3).

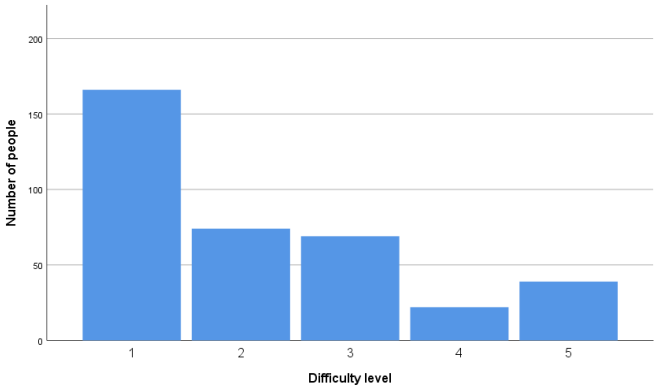

Figure 3: Frequency of people by difficulty level -Q11

Then, in order to analyse some motives related with those answers, we asked for suggestions regarding the disadvantages of traditional vaccines. We registered 161 answers and most of them are related to the pain caused by the needles of these vaccines, an element which causes both fear and panic in some people. Other motives are related to:

- the medical waste: vaccines can only be used once and then go to waste;
- the need for a qualified professional to administer the vaccine;
- the possible inflammation, swelling and scar left by the needle;
- the possibility of contamination through the needle;
- the dependency on good preservation and storage conditions;
- the related side effects;
- the travel to the administration site;
- the expensive cost: those that are not included in the national health plan.

In relation to question 13 (to understand if they had, in fact, understood what edible vaccines were), 95,1% of the sample understood the definition of edible vaccines. In order to know if people were willing to take the edible vaccines, we were able to gather the following answers: 4,9% of them chose the answer number 1, which means they do not consider taking it; 8,4% choose number 2; 24,6% opted for number 3; 23,2% preferred number 4 and 38,9% decided for number 5, having no problem in taking the edible vaccines (figure 4).

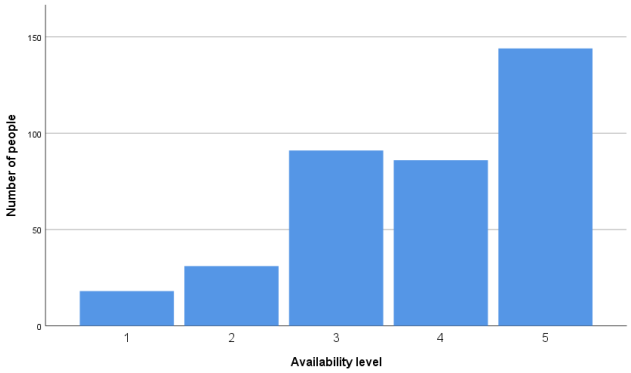

Figure 4: Frequency of people by availability level - Q14

This allows us to conclude that most people are available to consume this type of vaccine. Although these results are a step towards an easier implementation, we asked for suggestions on the subject. We were able to assemble 105 answers and the most addressed and important one is: providing information about edible vaccines, in numerous ways, like social media, health centers, hospitals, videos, lectures and leaflets, include it in education, articles and awareness programs. Other suggestions are more related with studies, underlining the need to do more of them to prove the efficiency and advantages of this type of vaccine. In short, people want to know, in detail, how these vaccines are produced and administered (information about the dosages, for example), what their advantages are over the old ones, how they work, their efficiency and side effects.

4.1.1 Pearson's chi-squared test

In this study, in some questions, we obtained answers rated from 1 to 5. Thus, these values had to be grouped, in the chi-squared test, since this test only accepts values rated less than 5. Hereupon, we considered answers 1 and 2 negative, creating a group, and answers 3, 4 and 5 positive, creating another group. Thus, we decided to, in SPSS, apply the chi-squared test (p-value=0,05) between variables of these selected questions: 1, 4, 5, 6 (grouped), 7, 8, 11 (grouped) and 14 (grouped). In the article we will only show the entire procedure once, between the two most relevant variables. For the rest of the variables, we will have, at the end of this section, a table with the significance values obtained.

First of all, we formulated the hypotheses to test the independence of the variables under study:
H0 = the variables are independent H1 = the variables are dependent

Then, we developed a contingency table with the expected values and those obtained from the two selected variables.

Table 2: Contingency table between variables from questions 11 and 14

Frequency							
		Q14 - Level of availability (edible vaccine				Total	
		Negative (No)		Positive (Yes)			
		Score	Expected Score	Score	Expected Score	Score	Expected Score
Q11 - Level of difficulty (traditional vaccines)	Negative (No)	38	32,9	201	206,1	239	239,0
	Positive (Yes)	13	18,1	118	112,9	131	131,0
Total		51	51,0	319	319,0	370	370,0

Finally, in SPSS, we applied a chi-squared test and the value of significance obtained was 0,111, which is higher than the initial considered p-value. Thus, we cannot reject H0, nor affirm something regarding the dependence or not of these variables.

The following table 3 presents the p-values/significance of all variables from the selected questions.

Table 3: P-values between the values/variables of the corresponding selected questions

Variables / Questions	Age Q1	Geographic localizations/Q4	Types of location/Q5	Knowledge about GMOs/Q6	For or against GMOs/ Q7	Influence of information transmitted about GMOs/Q8	Level of difficulty (traditional vaccines) / Q11	Level of availability to get edible vaccines/Q14
Q1	-	-	-	0,000	0,001	0,163	0,459	0,000
Q4	-	-	-	0,646	0,300	0,449	0,188	0,002
Q5	-	-	-	0,593	0,874	0,481	0,301	0,043
Q6	0,000	0,646	0,593	-	0,430	0,001	-	0,610
Q7	0,001	0,300	0,874	0,430	-	0,113	0,676	0,000
Q8	0,163	0,449	0,481	0,001	0,113	-	-	0,052
Q11	0,459	0,188	0,301	-	0,676	-	-	0,111
Q14	0,000	0,002	0,043	0,610	0,000	0,052	0,111	-

As we can see, in some chi-squared tests, we obtained a p-value less than 0,05. Since these values are low, we can reject H0 and conclude that those variables are dependent on each other. Analysing the values where our main variable - level of availability to get edible vaccines - is involved, we can conclude that it is associated with/dependent on age, geographic localizations, types of location and decision making - for or against GMOs. Thus, GMOs have a major role in this topic, and it is extremely important for people to be aware of their meaning and related studies in order to make a more thoughtful decision.

4.1.2 Calculation of Pearson's correlation coefficients

In order to check if the variables in some questions are linearly correlated, without grouping them, we selected the ones that are of most interest and, in SPSS, we calculated Pearson's correlation coefficients (table 4).

Table 4: Linear correlation coefficients between the values/variables of the corresponding selected questions

Variables / Questions	Age / Q1	Geographic localizations/Q4	Types of location/Q5	Knowledge about GMOs/Q6	For or against GMOs/ Q7	Influence of information transmitted about GMOs/Q8	Level of difficulty (traditional vaccines) / Q11	Level of availability to get edible vaccines/Q14
Q1	1,00	-	-	-0,212	0,092	0,005	-0,095	-0,064
Q4	-	1,00	-	-0,038	0,091	0,033	0,107	0,001
Q5	-	-	1,00	0,050	-0,019	-0,018	-0,024	-0,064
Q6	-0,212	-0,038	0,050	1,00	0,001	-0,140	-	0,026
Q7	0,092	0,091	-0,019	0,001	1,00	0,027	-0,059	-0,242
Q8	0,005	0,033	-0,018	-0,140	0,027	1,00	.	-0,009
Q11	-0,095	0,107	-0,024	-0,054	-0,059	0,029	1,00	0,137

Variables / Questions	Age / Q1	Geographic localizations/Q4	Types of location/Q5	Knowledge about GMOs/Q6	For or against GMOs/ Q7	Influence of information transmitted about GMOs/Q8	Level of difficulty (traditional vaccines) / Q11	Level of availability to get edible vaccines/Q14
Q14	-0,064	0,001	-0,064	0,026	-0,242	-0,009	0,137	1,00

As we can see in table 2, all values obtained in the selected questions present little or no linear correlation. Thus, there are weak linear correlations between the variables of questions 1 and 6, 4 and 11, 7 and 14, 11 and 14. However, since all of the coefficients are not close enough to 1 (positive correlation) or -1 (negative correlation), we can conclude that none of the factors that we questioned about - whether it was the age, the respondents' location, their knowledge about GMOs, the difficulty felt or not when administering traditional vaccines - affects, linearly, the availability of people to get edible vaccines. Not even the age factor significantly affects, linearly, the amount of knowledge or decision making for or against GMOs.

Hence, by analysing the correlation coefficient values, we can conclude that the availability of people to administer edible vaccines, asked in our main question (14), is linearly independent of any other factor questioned as well. Therefore, since this is a complex topic that needs national acceptance, it is very important not to have any factors interfering, in a linear way. Considering the suggestions made, the most crucial element in an easier implementation and acceptance is, in fact, the information transmitted. Individuals have the right to know every piece of correct information about this subject, which will allow them to decide whether they agree with this innovation or not and whether to get edible vaccines consciously.

4.2 Interviews

In addition to the online survey, we decided to conduct 15 interviews with health professionals so that more data could be collected. In the following table 5 we have outlined all 15 interviews by occupation, emphasizing certain aspects related to them.

Table 5: Data gathered from 15 interviews

Occupation	Number of interviewees	Gender	Ages	Duration of career	Place where they work	Relevant opinions
Nurses	9	100% F	23-58 years old	5 months and between 6 and 35 years	-Health Center Acute Consultation; -UCCI Mealhada; -Primary Health Care-Health Center; -Mira Health center; -IPO Coimbra; -Lamego (ERPI); - ACES Cávado III Barcelos / Esposende; -Local Health Unit of Matosinhos.	"Provide training and information to health professionals on the development and progress in the creation of edible vaccines." "Success will depend on transmitting sufficient information to the general public and the credibility of this new procedure among the scientific community."

Occupation	Number of interviewees	Gender	Ages	Duration of career	Place where they work	Relevant opinions
Doctors	1	100% F	58 years old	29 years	-Local Health Unit of Matosinhos.	"Probably the evolution towards acceptance will be rapid, due to the easier administration and not causing pain or discomfort caused by the injectable."
Pharmacists/ Researchers	4	50% F 50% M	23-38 years old	1-15 years	-Pharmacy; -Chemistry Center of Coimbra / UC.	"I am naturally skeptical of edible vaccines. In my opinion there are alternatives which can be carried out in more effective and safer ways, such as the administration of intranasal vaccines." "I think it will be a very well received innovation."
Student of pharmaceutical engineering	1	100% F	21 years old	4 years of the course, having some experience	-FFUP.	"I have certain doubts in their development, namely when it comes to the phenomena of contamination, the possibility of food interfering with the vaccine administration…"

Observing table 5, the interviewees integrate the age range between 21 and 58 years old, and the information collected from all 15 interviews proves to be extremely relevant.

Considering the answers obtained from the nurses, we are able to conclude most of them are not aware of what edible vaccines are. Only four of them have knowledge about this type of vaccine, and two of them claim to only know the concept vaguely. They told us that the biggest difficulties in administering traditional vaccines are related to the needles, the associated pain, the higher cost (those that are not included in the national health plan), the displacement, the lack of information and trust, religious and ideological convictions, the transmission of fake news and the fact that almost every child is restless during the procedure. The solutions they presented to us are, in the case of children, to have games available, videos playing or awarding them with balloons or diplomas in order to distract them. Telling them that vaccines provide superpowers and that their idols (for example, football players) also take them can be a good option. For the older patients, nurses simply need to explain the importance of vaccines. Almost all of the nurses are in favor of edible vaccines, as long as their effectiveness is proven. Two of them needed more information to make a decision, since they did not know what edible vaccines are. They also told us that they think the acceptance will be easy, if all of the information about this innovation is provided to both health professionals and their direct users, because they are painless and easier to administrate. The skepticism and the lack of evidence of effectiveness were also mentioned as being the main reasons for a tough implementation. One of the nurses also claimed that the pharmaceutical industry may contest this innovative vaccine. Therefore, they suggested a few practices that, in their opinion, will lead to an easier implementation: provide more information, make them available for free and make the laboratories bet on the scientific development of these vaccines.

Regarding the doctor who responded to our survey, she already knew about this innovation and approved of it, because of its utility in underdeveloped countries and its benefits for the planet. The difficulties of administration and corresponding solutions mentioned by her are very similar to those the nurses referred to.

She told us that the acceptance could be easy and that, once again, the lack of information could hinder its implementation.

Regarding pharmacists and researchers, just one of them had knowledge of what edible vaccines are. This individual revealed to be against them, since he thinks they have low credibility.

Considering that this innovation is easier to administer and avoids the adverse effects of traditional vaccines, the remaining respondents would be in favor of edible vaccines, if their pharmacological efficiency and safety of administration are proven. In these interviews, the access to appropriate spaces for administration purposes, the necessary materials, the fact that it is an intravenous administration and possible allergic reactions at the administration site were some of the difficulties in administering the traditional vaccines presented by the interviewees. The solutions, when it comes to the barriers previously mentioned, are understandably related to the transference to a Health Center, in case the health professionals do not have the necessary conditions to administer them, choose soft spots to administer the vaccines and make the pleats correctly and also advise the measures to be taken in case of allergic reaction. The pharmacists and researchers also informed us that it will be easy to accept this technology, depending on the price (if these vaccines are presented with a fair one, it can help with their acceptance) and if their effectiveness is proven. One of them also added that clinical studies are very time-consuming and expensive. Another suggestion was that these vaccines should have the State's contribution, in case they are expensive, and that they must be well studied before their implementation.

Lastly, in order to add the opinion of a student who is about to enter the labor market, we decided to interview a pharmaceutical engineer to be, who had very little knowledge about edible vaccines, expressing doubts about their development. The difficulties of administration and the solutions mentioned by her were identical to those referred previously by health professionals. She believes that these innovative vaccines will be easy to implement, but that the contamination phenomena can make this difficult.

Comparing the responses obtained from the online survey and the interviews, we realize they pursue a common goal: the transmission of information about these vaccines and proof of their effectiveness. These are the most important factors, both mentioned by professionals and users, thus allowing a global acceptance of edible vaccines.

Once we realize so few individuals are aware of this topic and the research behind it, our intent is no longer to just identify benefits and barriers of this innovation. Since it is a perfectly legitimate new form of a vaccination, this paper contributes to enlighten several individuals of different age groups and locations, in order for them to have a concrete idea of what may arise in the near future. This subject can be a bit controversial, due to the clear lack of general knowledge on this matter and the fact that it is unaddressed by many health professionals.

It is necessary to create and transmit more knowledge about this topic, since it represents a major innovation, carrying many benefits for society in general. In order to keep people informed and aware of how technology is changing, hopefully improving, with practices that are vital for our survival and which may increase the average life expectancy, the field of medicine and health has to develop any means that bring society closer to their findings.

5. Conclusion

The present article is an exploratory study that produces valid knowledge about an important and promising innovation in the health area: edible vaccines. Discovering knowledge and generating knowledge are the first steps in the knowledge management cycle (Jashapara, 2004).

Through the participation of the 15 health-professional interviewees and the adherence of 370 individuals to the survey, it was possible to draw conclusions and map out suggestions, specified in this section.

Interestingly, and as stated above, interviewee nurses told us that there are significant difficulties in administering traditional vaccines – including related to the needles, the associated pain, the higher cost, the displacement, the lack of information and trust, religious and ideological convictions, and the fact that almost all children are restless during the procedure. Thus, we see a need for edible vaccines.

The pandemic COVID-19 we are currently experiencing proved to be a barrier regarding contact with professionals in person. Their time to reply to the survey was limited due to the complexity of the situation, and a face-to-face conversation was not always possible.

Regardless of all of the complications in the process of developing it, this article advances the study and can contribute to the general insight of this innovative method. Furthermore, this paper allows an improvement of knowledge in the field of medicine and health. Since this theme is still waiting to be explored and invested in, the present article allows its readers to comprehend the technical part involved, as well as to draw conclusions from the results suggested by our research: there may be a broader acceptance of this type of vaccine than previously thought.

Therefore, it seems possible, as implied by the literature review and the perceptions and suggestions we obtained, to evolve and create more knowledge around edible vaccines.

In terms of major conclusions, we are able to infer that the general knowledge about Genetically Modified Organisms (GMO) is associated with the information provided by the media about them, for example, related to food - genetic changes in corn, beta carotene rice, among others, as already expected. Another interesting finding is related to the fact that the level of willingness to get an edible vaccine depends on being in favor or against GMO´s. The fact that the propensity of our sample to take edible vaccines is not linearly dependent on any factor, as we can see by looking at the results, is very positive, meaning individuals are prone to including these in their lives.

The clearest finding of this study is that a correct distribution of information about these vaccines (or the effective management of knowledge dissemination) and the proof of the edible vaccines' effectiveness are of the utmost urgency, especially if we want people to welcome this method of vaccination and, further ahead, use it. The fact that, for example, only one of the pharmacists and researchers had knowledge about the edible vaccine topic, made us realize that this needs to be further explored and brought to light. Therefore, the present study urges us to suggest to the interested industry to improve its marketing communication, by transmitting more and accurate information about studies related to edible vaccines. The state of progress regarding edible vaccines needs to be brought to the public in newscasts, science papers, magazines, health centers and hospitals.

The opinions we gathered, from both health professionals and the public in general, turned out to be useful and constructive, enabling us to comprehend in what ways this innovative vaccine can act and be valuable to our society. Their suggestions, essentially related to the transmission of more and qualified information about this topic, can represent some of the paths to take in order to prove that this innovation is, in fact, the key to overcome many of the restrictions found when considering injections, most of which are related to fear, pain, possible secondary side effects and waste.

Management innovations are implemented with the purpose of improving the performance of a company or industry (Panwar et al, 2018). In this specific case, we are convinced that the health and pharmaceutical industry can benefit from the acceptance and implementation of edible vaccines, since this opposes some of the previously mentioned restrictions. We must also highlight that scientific advances, when based on innovation, are one of the major sources of economic growth (Chaminade and Lundvall, 2019).

A business process innovation is a completely new process, or an improved one, that differs significantly from the previous business processes (Perani, 2019, based on the Oslo Manual). Admitting that edible vaccines undoubtedly fit into this description, we are certain that this article can contribute to the enlightenment of this existing innovative form of vaccines - edible ones - this being a very promising innovation in the health sector in the near future. Furthermore, we believe our research can serve as a reference point and call to action for science and health practitioners in the field.

6. Future studies

In future studies, this subject can be further investigated, both in terms of research and proof of the effectiveness of edible vaccines, as well as continuing to assess people's knowledge of them and the propensity to choose this innovation, instead of traditional vaccines.

Furthermore, it would be interesting to extend this study, in order to comprehend the reasons behind the individuals' opinions and predispositions, when it comes to the subject.

It is also very important to keep on creating content on this topic, in order to raise people's awareness and improve their knowledge. Future researchers on the topic could also opt for an approach that could get them closer to the experts in the field, in order to boost credibility in this sort of vaccination. Future research could also increase the sample size in the field work when addressing the topic.

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Influence Networks Relating to Health Knowledge Among Nairobi's Micro-Retailers and Their Clients

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Abstract: TRANSFORM, founded in 2015 by Unilever and the UK's Department for International Development, supports several social enterprises by combining public sector resources with private sector technical capabilities and networks to support innovative social enterprises. Digital programs have enabled social enterprise partnerships to expand the reach of their initiatives to broader audiences including specifically defined groups that hitherto were untapped or difficult to reach. Unilever partnered with TRANSFORM and Every1Mobile to develop UJoin and UAfya in informal settlements of Nairobi, Kenya. UJoin is a social enterprise initiative for promoting business growth among underserved neighborhood shops called dukas. UAfya focuses on young expectant and new mothers, and women interested in family and maternal health topics. Each initiative uses an online community network to discuss and improve knowledge and behaviors regarding livelihoods and health. Online communities provide opportunities to reach specific groups with targeted behavior change messages and campaigns. However, little systematic knowledge is currently available on how to develop, and scale-up effective behavior change programs for digital communities in low-income markets. There is also little information about key guiding principles and best practices that underlie successful digital and online, social networking models. A systematic and participatory tool known as Net-Map was used to explore and understand potential frameworks for establishing digital-based community-driven partnerships with the private sector for health promotion through behavior change. The Net-Map approach was used to help individuals and groups clarify their view of a situation (including networks and power structures), foster discussion, and develop a strategic approach to their networking activities. Eight Net-Maps were constructed, stratified by groups based on location and digital platform. Each map was constructed by an average of 9-10 people for a total of 76 participants. Seventy-six participants identified actors – stakeholders and groups of people involved - and influential links – ways actors are connected - through the Net-Map activity. Among UAfya participants, local government, family, and friends, and the media were identified as the most important actor types. A comparison of the discussions associated with the creation of the maps by UAfya members shows that the two most important link types are conflict, and collaboration/partnership. Among UJoin participants, the three most important actor types were local government, business and financial institutions, and customers. UJoin members identified regulation, and conflict and competition, collaboration and, information sharing as key links between actors. Recommendations based on findings support a vision for scale-up of the UJoin and UAfya programs through accreditation and branding of a novel type of duka. Shop keepers would be trained and knowledgeable to provide high-quality services to improve customer health while also selling health products that benefit the bottom line.

Keywords: Social networking analysis, influence mapping, participatory methods, health communication, visualization, low- and middle-income countries, Kenya

1. Introduction

According to UNICEF (2019a), Kenya has a high maternal mortality rate at 342 per 100,000 live births. Per a joint WHO and UNICEF report (2019b), only 59% of Kenyans have access to basic water services and fewer (29%), have access to sanitation services. Estimates from a UNICEF study (2017) suggest that 26% of Kenyan children under age five suffer from nutritional deficiencies and stunting, higher than peer countries such as Ghana and Mauritania.

Online communities provide opportunities to reach specific groups with targeted behavior change messages and campaigns (Wakefield, Loken, and Hornik, 2010; Eysenbach, 2007; Wasko and Faraj, 2000). Online communities focused on health capabilities have uncovered ways to bridge health disparities between rural and urban areas (Goh, Gao and Agarwal, 2016).

However, little systematic knowledge is currently available on how to develop, and scale-up effective behavior change programs for digital communities in low-income markets. There is also little information about key guiding principles and best practices that underlie successful digital and online, social networking models.

Digital tools and the ecosystems they belong to hold great promise and potential for addressing deficits in health care delivery networks in Africa. Opportunities for improving networks can be realized with commitment and investment from government actors, in tandem with local public and private stakeholders (Tambo et al, 2016).

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Innovative models for scaling products and services place digital tools at the center of efforts to bring together stakeholders' intellectual capital and knowledge (Presch, 2020).

2. Micro-retail enterprises in Kenya

In Kenya, micro-retail establishments known locally as dukas are pervasive in low-income and under- resourced communities, and serve as primary retail outlets for the majority of the population. Dukas capture a substantial portion of the retail market and supply about 80% of consumer goods in Kenya (TechnoServ, 2019). Thus, dukas are strategically positioned to serve as conduits to underserved segments of the population. According to Nielsen, there are over 166,000 dukas in Kenya (Mwiti, 2018). Only 10 percent of these dukas have received business training (TechnoServ, 2002) and of those in Nairobi, more than half do not record their sales (Waweru, 2018).

The Transformative Market Based Model for Low Income Household Needs (TRANSFORM) Project in Nairobi, Kenya, (led by DFID and Unilever) revolves around two initiatives, UJoin and UAfya (Wright, et al., 2019; Hendrickx, et al., 2018). Both UJoin and UAfya are digital mobile-friendly platforms that provide services to duka owners. Each initiative uses an online community network to facilitate discussion, and improve knowledge and behaviors regarding livelihoods and health. UJoin and UAfya also seek to build on the formal and informal health communications already happening among micro-retailers, their customers, government regulatory bodies, health professionals, and school teachers

Johns Hopkins Center for Communication Programs (CCP) reviewed six initiatives - independent of TRANSFORM- that use online communities to facilitate behavior change to inform a scale-up model. The results of this review identified five key dimensions important to scaling digital programs:

- Competitiveness: Clear understanding of the ecosystem and the levers that create an enabling environment for growth.
- Capacity: Competence and resources required for sustainable diffusion of innovation.
- Capability: The utility and productivity that consumers derive from the platform.
- Communication: Clear articulation and positioning of a compelling value proposition.
- Collaboration: Strategic partnerships that provide holistic solutions.

2.1 UJoin Digital Platform

UJoin is a digital platform that aims to increase business capacity and skills, and access to services and discounted products among duka owner in Kenya (Wright, et al., 2019). Duka owners who register with UJoin have direct access to tools they need to improve their business management skills and to expand their business. The platform, had about 3,000 registered members at the time of the survey. Components of the platform include a duka academy (with courses on financial and credit management, pricing and promotion, record keeping, and business planning), information and links to business support services such as credit and lending institutions and wholesalers, online mentoring and peer-to-peer networking, and a loyalty rewards scheme (UJoin 2019).

2.2 UAfya Digital Platform

UAfya is a digital program that focuses on young expectant and new mothers, and women interested in family and maternal health topics. The platform had about 1,500 registered members at the time of the survey. UAfya aims to improve nutrition and hygiene knowledge and behaviors among new and young mothers in Kenya. The need for this is supported by maternal and neonatal data from Kenya.

Dukas help community members develop knowledge about items that can be purchased locally including nutrition supplements and snacks for infants, toddlers, and children, and personal and feminine hygiene products such as deodorant and soap. They also can provide nutritional advice regarding foods they sell for infants, toddlers, children, and reinforce the benefits of eating healthy foods (Demmlera, Ecker, and Qaim, 2018).

Scaling up initiatives like UJoin and UAfya to increase the reach of information and services among dukas requires understanding of the duka community and its networks. Successful program scale-up also includes strategies to support the needs of a larger and more diverse audience. However, there is little information about

the needs of duka owners beyond skills related to management. More information is needed about their trusted support systems, collaborative networks, information-seeking behaviors, relationships with patrons and each other. This information can be used to inform scale-up and develop strategic interventions that support duka owners personally as well as professionally.

2.3 Net-Map

A systematic and participatory tool known as Net-Map (Campbell, et al., 2014), developed by Eva Schiffer, was used to explore and understand potential frameworks for establishing digital-based community-driven partnerships with the private sector for health promotion through behavior change. The Net-Map approach is used to help individuals and groups clarify their view of a situation (including networks and power structures), foster discussion, and develop a strategic approach to their networking activities. It allows groups to visualize key channels and consumer influences. Net-Map has been used in health settings in many low- and middle-income countries. Net-Map has contributed to a better understanding of knowledge exchange among family planning and reproductive health organizations in Ethiopia (Harlan, Sullivan, and Hailegiorgis, 2013.), mobile phone interventions for community workers in Malawi, (Campbell, et al., 2014), and young child feeding policy in Pakistan (Mahmood, et al., 2017).

Th Net-Map activity aimed to provide a deeper understanding of the communication paths and challenges to effectively scale up the diffusion of healthy behaviors for the UAfya and UJoin initiatives. It seeks to understand how to strengthen government involvement in developing the micro-retailers to expand their circle of influence beyond business and become involved in other sectors (health, agriculture, education). It also seeks to understand how to decouple the micro-retailers from foreign aid and create local sustainability and ownership of healthy communities. This means fostering government roles in connecting micro-retailers to develop formal mechanisms for acquiring knowledge from health professionals and educators, and goods from local farmers.

When supported appropriately, duka owners may be in a position to reinforce community behaviors to improve infant care and maternal health by supplementing and promoting messages with business customers, that they receive from health educators and other authoritative health professionals.

3. Methodology

The study used qualitative methods, specifically net mapping techniques, to identify and explore the influence of community social actors on health discussions among dukas with retail shops located in two informal settlements, Kibera and Kawangware, in Nairobi, Kenya. Net-mapping was used to develop a visual representation of linkages in the social network of dukas in the study communities.

Investigators developed the specific method, including lines of inquiry, by incorporating the rich body of case study research. This included asking participants to describe the current context through narrative, and speculate on what the future may look like when certain actions are carried out (Yin, 2014; Massaro, Dumay, and Bagnoli, 2019).

3.1 Study Population

The study target population was adult (18 years and older) male and female managers of dukas registered with UJoin, and adult (18 years and older) females registered with UAfya online platforms.

3.2 Sample Selection

UJoin and UAfya community coordinators assisted with the identification of potential participants. Eligibility criteria for inclusion in the study included managing a duka, being registered with UJoin or UAfya, residence in Kibera or Kawangware for at least 12 months, being 18 years of age or older, and providing voluntary informed consent. In addition to eligibility criteria, a purposeful sample was selected to increase variability and likelihood of representation of diverse backgrounds, perspectives, and experiences within the sample. Sampling criteria also included registrants who: placed within the top 15% and bottom 15% of visits to the digital platforms, had signed up the most customers to their loyalty club, had redeemed the most achievements and trophy badges, had completed the most e-learning courses on the site, or had asked for health-related information about products through the platforms.

3.3 Sampling

Four mapping activities, two in Kibera and two in Kawangware, were designed. At each site, one workshop included registered UAfya members and the second included registered UJoin members.

3.4 Data Collection Tools:

The main net-map questions of interest were:

- UAfya: Who influences knowledge exchange related to healthy behaviors within the communities of shoppers?
- UJoin: Who influences perceptions among the shopkeepers about their roles in promoting healthy behaviors?

3.5 Net-Map Process

The map was constructed in phases. First, working in groups, participants used an open card sort activity to identify actors (influencers) and link types (relationships). Next, participants were re-grouped by age (UAfya) and the number of years managing a duka (UJoin). These groups then were guided by the facilitators to create a map depicting the following information and drawing these on flip-chart paper:

1. The actors influencing the question.
2. The types of links connecting the actors.
3. The strength of each linkage on a three-point scale with '1' representing a weak link, '2' a regular link, and '3' a strong link.
4. The influence level of each actor on an eight-point scale with '1' representing a low level of influence and '8' representing a high level of influence. This scale range was determined from influence towers during the pre-test.
5. Whether the actors were aligned with the question as it relates to the overall TRANSFORM goals on a three-point scale (negative, neutral, positive).

Next, facilitators guided participants through a visual analysis of the completed map. First, participants provided their intuitive reactions to what they were seeing on the map, and second, through guiding questions about individual actors and cliques on the map. The guiding questions assessed betweenness centrality, a measure of how often an actor linked others who were not directly linked, and closeness centrality, a measure of the number of steps from one actor to all other actors in the network. Plurality refers to the number of votes cast for actors who receive more than any others but does not receive an absolute majority.

Lastly, the groups representing the two platforms reconvened to compare their maps. Additional discussion among the participants provided insightful and explanatory detail about the differences and similarities in the maps from different groups and locations.

A pre-test of the Net-Map process was completed with 15 UJoin and UAfya project managers in Nairobi. The activity enabled a review of the mapping procedures, guiding questions, potential links, and actor types that were developed using pre-existing knowledge of the local context. After-action review of the pre-test results was conducted to refine plans for data collection.

3.6 Ethics and Protections

The study protocol was reviewed by the Johns Hopkins University School of Public Health Institutional Review Board, and designated not-human subjects research under protocol #9786. Procedures to protect participants' rights and information were included in the data collection and management process. No names or personal and private information was collected in the notes or maps, and the data analyzed were de-identified. No data was collected before obtaining informed consent from all participants.

3.7 Permissions

Local permissions for community entry and to conduct the study were obtained from community leaders at each site, prior to approaching any potential participants.

3.8 Data collection

The data were collected at community centers in Kibera and Kawangware over a period of four days in September 2019. The net mapping activity was facilitated by program officers from Johns Hopkins CCP and

community coordinators from the UJoin and UAfya programs. Notetakers captured the discussions among the group as they constructed the net-map.

3.9 Analysis

The data collected from the maps and notes were inputted into proprietary software, ©Datamuse (2020). The maps were analyzed quantitatively for closeness and betweenness. Other quantitative measures summarizing the influence of actors examined the relationship between the number of connections and the degree of alignment with TRANSFORM goals. The analysis included isolation (or disaggregation) of specific portions of maps for separate analysis, such as all links of a certain type, or all links to a certain actor, to generate information about a specific influence or actor.

4. Findings

Eight net-maps were constructed by shopkeepers and women interested in family health. They were stratified by groups based on location and digital platform. Each map was constructed by an average of 9.5 individuals for a total of 76 participants. The average time to complete one map was seven hours. Table 1 below summarizes the key terms for interpreting the net-map.

Table 1: Summary of legends and symbols used to create the Net-Map visual

Information summarized	**Graphical representation**
Actors	Depicted by circles
Types of actors	Indicated by the color of each circle
Influence of actor	Depicted by the size of the circle (larger = more influence)
Linkages	Depicted by arrows
Types of linkages	Indicated by the color of each arrow
Strength of the relationship	Suggested by the thickness of the arrow (thicker = stronger relationship)

For each of the eight maps shared in this article, a corresponding influence-connection matrix is included. On these matrices, points reflecting more than one actor (i.e., when the number next to the point is greater than 1), the color of the point may not reflect the type of all actors at that point.

4.1 UAfya Results

4.1.1 Actor Types

A comparison of the discussions associated with the creation of the maps produced by Kibera and Kawangware. UAfya members show that three actor types are the most important: local government, family, and friends, and the media. Overall, actor types identified were similar between the study communities. These are summarized in Table 2 below.

Table 2: Actor types identified in Kibera and Kawangware

Kibera	**Kawangware**
Family and Friends	Family and Friends
Government	Government
Media	Media
Social communities/CBO (community-based organizations) /NGO	Community Institutions
Business Partners	Companies

Kibera	**Kawangware**
Health Practitioners	NGOs

Key differences were evident for labels for business partners versus companies, and social communities/CBOs/NGOs versus community institutions. In addition, actor types with different scopes were health practitioners in Kibera and promoters/advertisers in Kawangware.

4.1.2 Link Types

A comparison of the discussions associated with the creation of the maps by UAfya members shows that the two most important link types are conflict, and collaboration/partnership.

Overall, link types identified were similar between the study communities. These are summarized in table three below.

Table 3: Link types identified in Kibera and Kawangware

Kibera	**Kawangware**
Information Sharing	Communication
Collaborating and Partnering	Partnership, Collaboration, Funding
Trading and Services	Trading
Conflict	Conflict
	Providing Services

Key differences were evident for labels for information sharing versus communication, and trading and services formed one link in Kibera while in Kawangware, these two links were separated.

Maps generated for actor and link types derived from sub-groups of the sample - younger versus older participant groups - are presented below for each of the two study locations.

4.2 Kibera: Older Participants

In Figure 1 below, results show that a total of 25 actors or groups of actors were identified by older participants. The plurality of these actors were business partners (6), and government (5) actors.

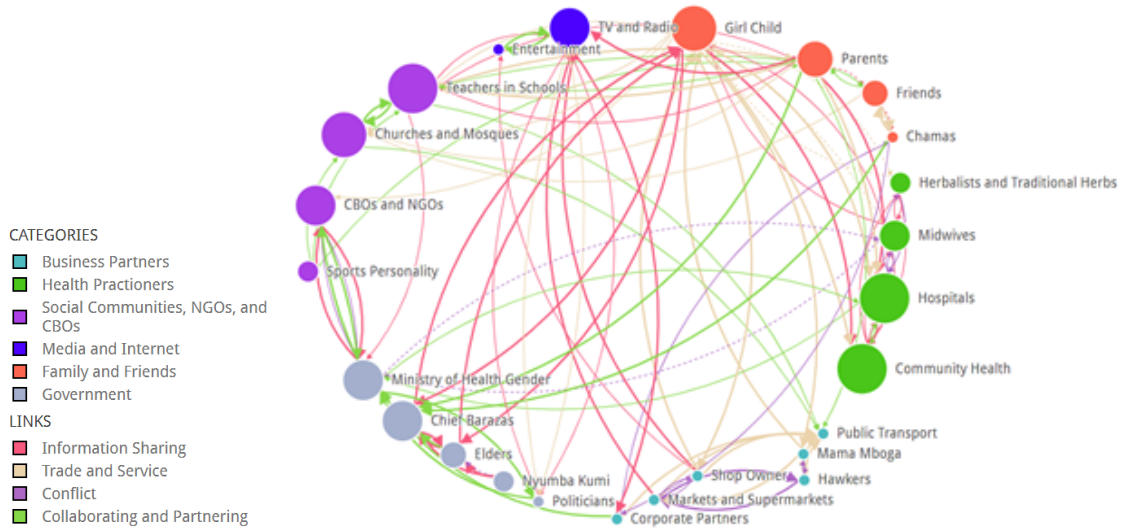

Figure 1: Net-Map of actors and linkages for older participants from Kibera

4.2.1 Actors

The map also showed that among all actors, teachers in schools, community health actors, and hospitals had the highest influence rating (eight on a scale of 0-8). In this and subsequent maps, Actors that are unique to Kenya include Mama Mbogas, informal vegetable sellers, and Nyumba Kumi, a neighborhood watch organization centered on groups of 10 houses. The girl child is defined as girls of school age.

4.2.2 Linkages between Actors

A total of 108 links were identified by older participants, including information sharing (35) and trade and services (30). According to this group's map, 47 links were defined as strong, 53 were normal, and eight were weak.

4.2.3 Influence and connections

In Figure 2 below, a matrix compares the number of connections for each actor (X-axis) with their influence (Y-axis). Results showed that friends and family were perceived to have higher influence and more connections (top right quadrant) compared to business partners and government actors with fewer connections and less influence (bottom left quadrant). Teachers in particular (identified with a green square), had a high level of influence and a high number of connections. The girl child, (identified by the red dot furthest to the right) also had notable influence and was highly connected among all the actors. Social communities/NGOs/CBOs were classified as having high influence but were poorly connected. The least influential and connected actors were the government and especially business partners and media and the internet.

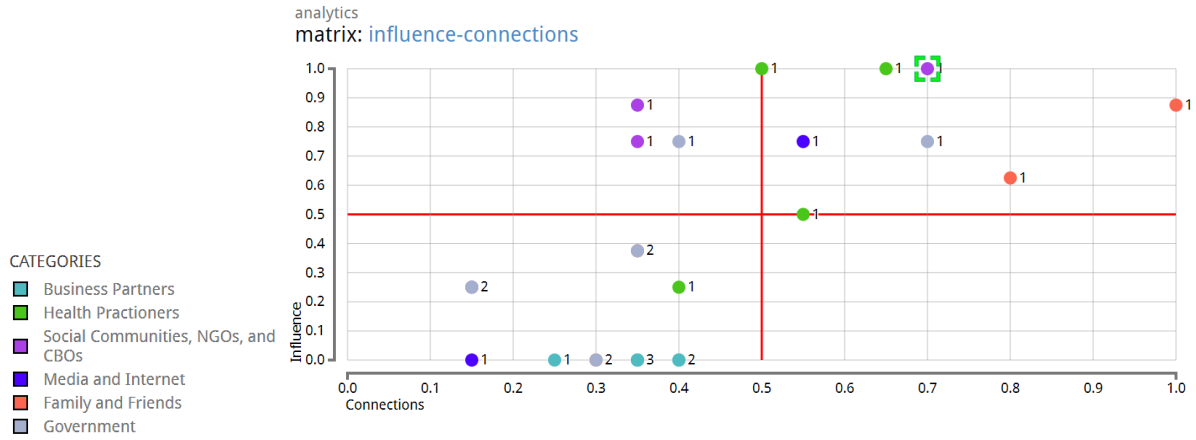

Figure 2: Influence-Connection matrix for older participants from Kibera

The key findings for social network metrics, closeness and betweenness, are as follows:

- Closeness: The girl child was the most closely linked to all actors in the network. This network was close-knit with many close connections across actors. Relative to the girl child, all other actors shared a similar and lower closeness factor.
- Betweenness: the girl child, public transport, television and radio, parents, and chief barazas (representatives of the local chief) made key intermediary connections by linking other actors who did not have relationships with one another.

4.3 Kibera: Younger Participants

In Figure 3 below, a complete Net-Map depicting relevant actors and linkages is shown for the group of younger (less than 28 years of age) participants from Kibera. A total of 25 actors or groups of actors were identified by younger participants and the majority of them were business partners (7) and health practitioners (5).

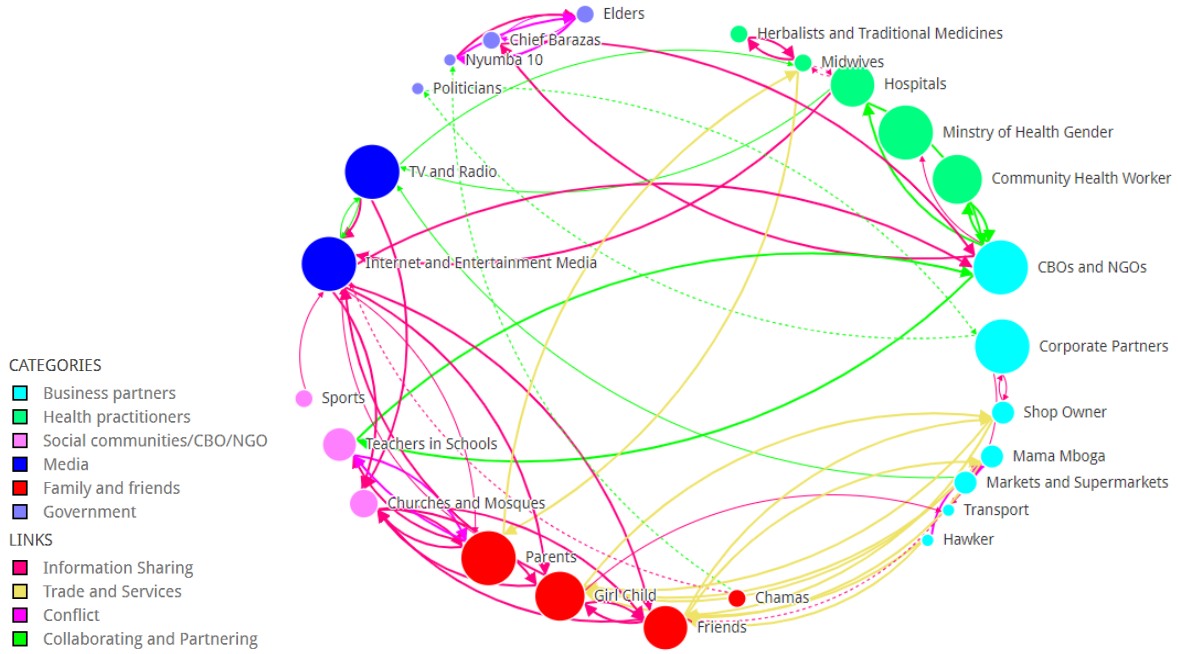

Figure 3: Net-Map of actors and linkages for younger participants from Kibera

4.3.1 Actors

The map also showed that among all actors, corporate partners, CBOs and NGOs, MOH's gender unit, television and radio, internet and entertainment media, and parents had the highest influence rating of eight on a scale of 0-8.

4.3.2 Linkages between Actors

A total of 67 links were identified by the young participants from Kibera, including information sharing (34) and collaborating and partnering (14). 45 of the links were defined as strong, 15 were normal, and seven were weak.

4.3.3 Influence and connections

In Figure 4 below, a matrix compares the number of connections of each actor (X-axis) with their influence (Y-axis). Among younger participants from Kibera, friends and family actors had higher influence and higher connections while business partners and government actors had fewer connections and less influence. Teachers, identified with a green square, were perceived to have a moderate level of influence but a low number of connections. The internet and entertainment media (blue dot in the extreme top right) had the strongest influence and connection compared to other actors. Younger participants rated substantially more actors with fewer connections and less influence than the older participant group, and these were primarily business partners and government. Health practitioners were perceived to be influential but lacked connections while social communities had low influence and variable results for connections.

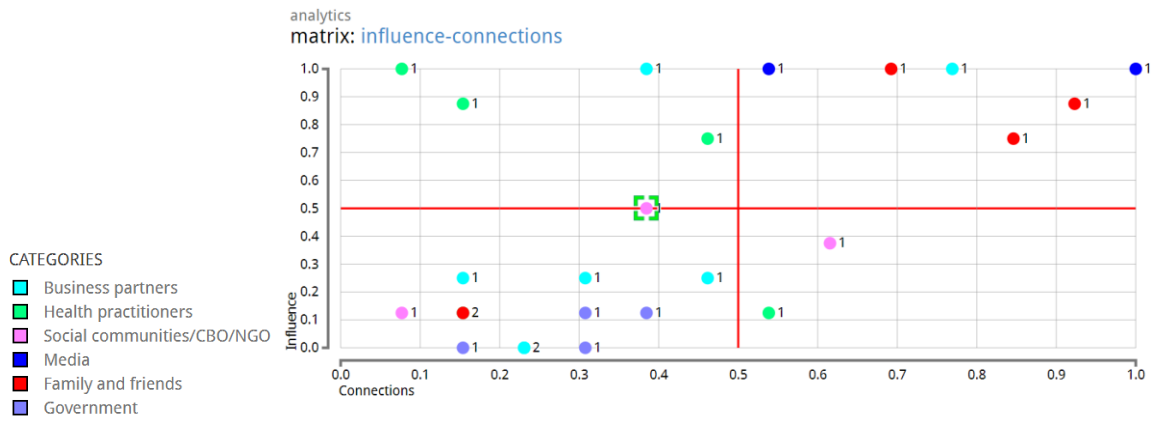

Figure 4: Influence-Connection matrix for younger participants from Kibera

Social network analysis metrics: Closeness and Betweenness

- Closeness: The girl child, CBOs and NGOs, hospitals, churches and mosques, TV and radio, internet and entertainment media, chamas, parents, friends, and elders were most closely linked to all actors in the network. Relative to the actors listed above, the other actors shared a similar and lower closeness factor.
- Betweenness: the girl child, CBOs and NGOs, and internet and entertainment media had connecting roles and linked other actors but did not necessarily have relationships with one another. Hawkers, herbalists and traditional medicine vendors, the Ministry of Health/Gender unit, community health workers, sports figures, and politicians had the lowest scores for betweenness.

4.4 Kawangware: Older Participants

In Figure 5 below, a complete Net-Map depicting relevant actors and linkages is shown for older (30 years and older) participants from Kawangware. Older participants identified 31 actor types the majority of whom were community institutions (8), companies (6), or NGOs (6). Small and medium-sized businesses have been anonymized.

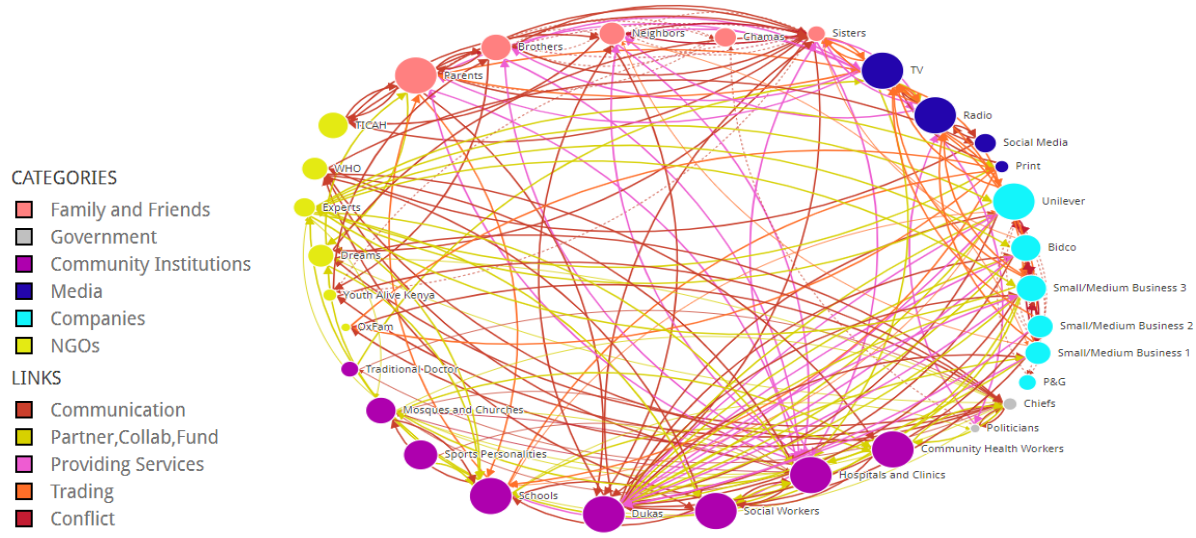

Figure 5: Net-Map of actors and linkages for older participants from Kawangware

4.4.1 Actors

The map showed that schools, hospitals and clinics, social workers, dukas, community health workers, television, radio, parents, and Unilever Company had the highest influence rating of eight on a scale of 0-8, among all the actors.

4.4.2 Linkages between Actors

Older participants identified substantially more linkages than younger participants. Specifically, a total of 206 links were identified including communication (86) and partnership, collaboration, and funding (49). According to this group's map, 157 links were defined as strong, 23 were normal, and 26 were weak.

4.4.3 Influence and connections

In Figure 6 below, a matrix compares the number of connections of each actor (X-axis) with their influence (Y-axis). The results show that older participants from Kawangware perceived that companies, community institutions, media, and friends and family, had higher influence and more high connections while NGOs and government actors had fewer connections and less influence. Schools, in particular, identified with a green square, had a high level of influence and a high number of connections, as did television, hospitals and clinics, and dukas respectively.

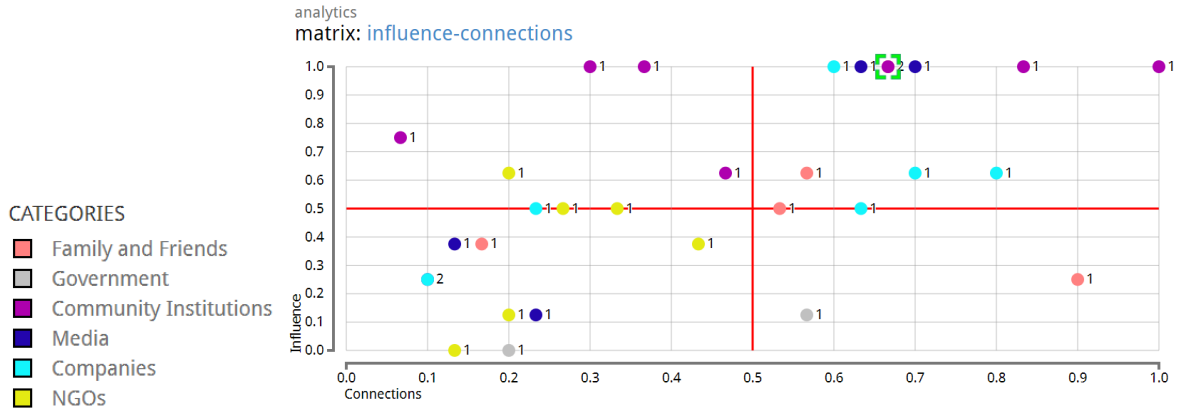

Figure 6: Influence-Connection matrix for older participants from Kawangware

Social network analysis metrics: Closeness and Betweenness

- Closeness: Twenty actors shared the highest status pertaining to relative proximity to all actors in the network. Schools, radio, TV, Unilever, brothers, Bidco, and Small/Medium Business 3 were among these 20 actors. The remaining 11 actors shared a similar and lower closeness factor.
- Betweenness: Schools, hospitals and clinics, and television had the most connecting roles by linking other actors that did not necessarily have relationships with one another. Chamas (women's collectives), sports personalities, social media, Proctor and Gamble, the Trust For Indigenous Culture And Health (TICAH), and OxFam shared the lowest betweenness factor.

4.5 Kawangware: Younger Participants

Figure 7 below is a complete Net-Map depicting relevant actors and linkages for younger participants (younger than 30 years) from Kawangware. A total of 30 actors were identified by younger participants, and the majority of these actors were community institutions (8) and companies (6). Small and medium-sized businesses have been anonymized.

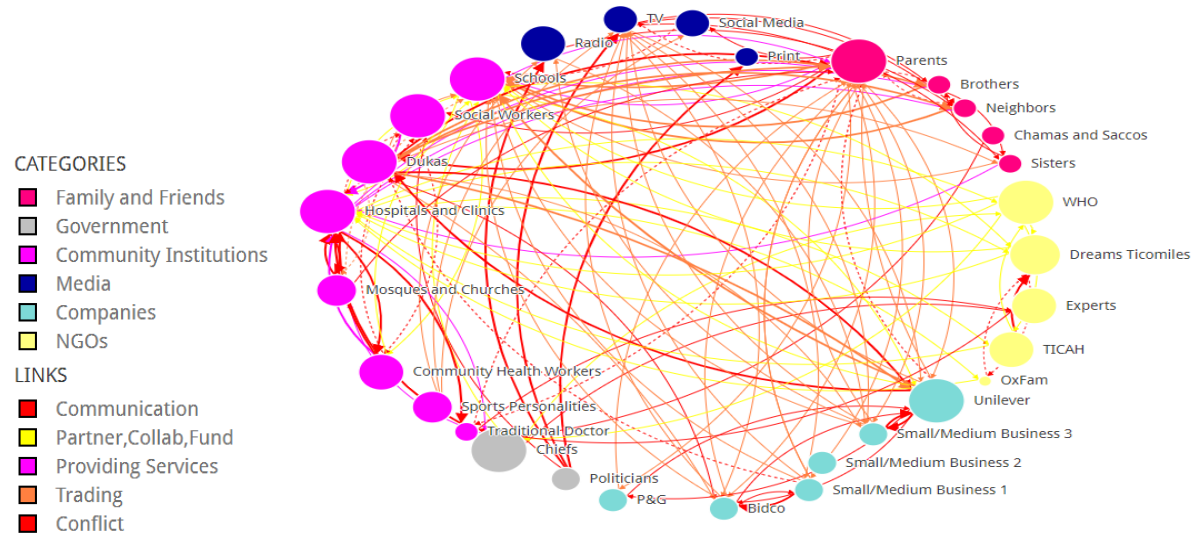

Figure 7: Net-Map of actors and linkages for younger participants from Kawangware

4.5.1 Actors

The results showed that schools, parents, chiefs, hospitals and clinics, social workers, Unilever company, the World Health Organization, and dukas had the highest influence rating of eight on a scale of 0-8.

4.5.2 Linkages between Actors

A total of 128 links were identified by younger participants from Kawangware including trading (42) and conflict (38). According to this group's map, 28 links were defined as strong, 84 were normal and 16 were weak.

4.5.3 Influence and connections

Figure 8 below compares the number of connections of each actor (X-axis) with their influence (Y-axis). Few actors in the community institution category had high influence and high connections while most companies had fewer connections and less influence. Community institutions, especially schools (identified with a green square) had a high level of influence and a high number of connections, as did hospitals and clinics, and parents. Parents (red dot in the top right corner) were perceived to have the highest number of connections and influence. However, younger participants identified more actors with high influence but limited connections, such as NGOs, a result that is similar to that of the older participants. Unlike the older participants, the younger participants perceived companies and the media as having less influence and connections, however, this may refer to media channels for business rather than for social and entertainment purposes.

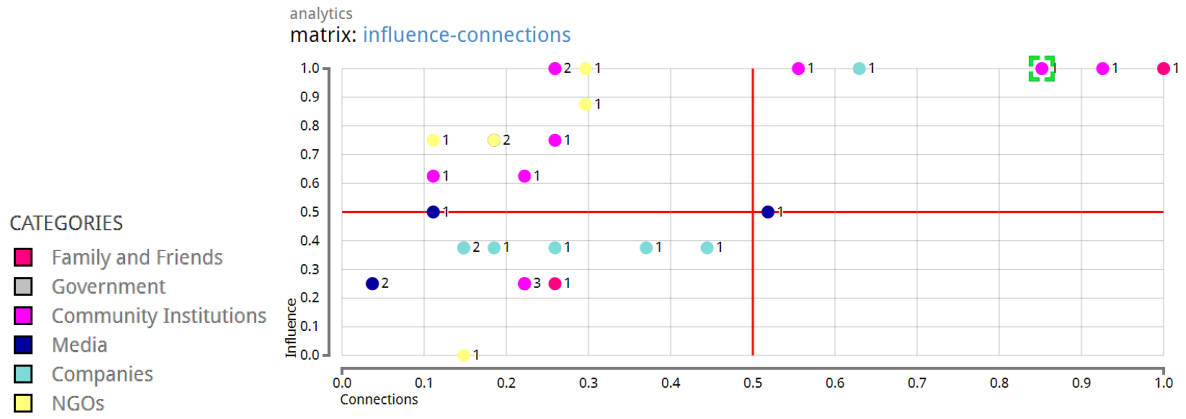

Figure 8: Influence-Connection matrix for younger participants from Kawangware

Social network analysis metrics: Closeness and Betweenness

- Closeness: 21 actors shared the highest status pertaining to relative proximity to all actors in the network. Schools, hospitals and clinics, Unilever, dukas were among these 21 actors. The remaining 9 actors shared a similar and lower closeness factor.
- Betweenness: Schools, hospitals and clinics, parents, chiefs, television, and community health workers, had connecting roles by linking other actors that did not necessarily have relationships with one another. Chamas (women's cooperatives) and Saccos (credit cooperatives), print media, Small/Medium Business 1, Small/Medium Business 2, the Trust For Indigenous Culture And Health (TICAH), OxFam, and health experts shared the lowest betweenness factor.

Table 4: Summary of Net-Map results for actors, connections, perceived influence, and connectedness, by study site

UAfya				
	Kibera		**Kawangware**	
	Younger	**Older**	**Younger**	**Older**
# Actors	**25**	**25**	**30**	**31**
# Connections	**67**	**108**	**128**	**206**
High Influence and Many Connections	Family and Friends Media	Family and Friends Health Practitioners	Community Institutions Family and Friends	Companies Community Institutions Media Family and Friends
High Influence and Few Connections	Health Practitioners	Social Communities NGOs, CBOs	Community Institutions NGOs	Community Institutions
Low Influence and Many Connections	Social Communities NGOs, CBOs	None	None	Government

UAfya				
	Kibera		**Kawangware**	
	Younger	**Older**	**Younger**	**Older**
# Actors	**25**	**25**	**30**	**31**
# Connections	**67**	**108**	**128**	**206**
Low Influence and Few Connections	Government Business Partners	Government Business Partners	Companies	NGOs

4.6 UJoin Participants

The discussions and maps created by participants that were members of the UJoin digital platform were compared for those residing in Kibera and those in Kawangware.

4.6.1 Actor Types

Overall, UJoin participants in Kibera and Kawangware identified similar types of actors in their community. The three most important actor types were local government, business and financial institutions, and customers.

Table 5: Actor types identified in Kibera and Kawangware

Kibera	**Kawangware**
Customers	Customers
Government	Government
Financial Institutions	Financial Institutions
Shop Owners	Shop Owners, Landlords, Premises, Security
Suppliers, Promoters, and Manufacturers	Suppliers
Wholesalers	Wholesalers, Hawkers, and Distributors

There were few differences in scope regarding how actor groups were defined. Specifically, in Kibera, “wholesalers” were identified as a distinct group, while in Kawangware, the group was broader and included distributors, and hawkers. Conversely, in Kawangware, “suppliers'' was a distinct actor type, while in Kibera, it was broadly defined to include manufacturers and promoters. Last, in Kibera, “shop owners” was a distinct link while in Kawangware they were combined with landlords, premises, and security.

4.6.2 Link Types

Participating UJoin members identified regulation, and conflict and competition, collaboration and information sharing as key links between actors.

Table 6: Link types identified in Kibera and Kawangware

Kibera	**Kawangware**
Conflict and Competition	Competition
Trading	Stocking
Regulation	Regulation and Rules
Information Sharing/Price List Checking	Communication
Partnership, Collaboration, Support, Facilitation	Discounting and Pricing

The other link types were similar but differed in scope or labeling. Specifically, in Kibera, "Information sharing" was combined with "price list checking" compared to "Communication" in Kawangware, and "partnership, collaboration, support, facilitation" was a distinct category in Kibera compared to "discounting/pricing" in Kawangware.

Length of time managing a duka was dichotomized into a short time (less than 6 years) and a long time (6 or more years). Those with less than 6 years of duka management were labeled 'new managers' and those with 6 or more years of duka management were labeled 'experienced managers.' Maps were generated for sub-groups of the sample based on the average number of years the group had managed a duka, for each study site.

4.7 Kibera: New Managers

Figure 9 below is a map for participants from Kibera who had managed a duka for a short amount of time. They identified a total of 36 actors.

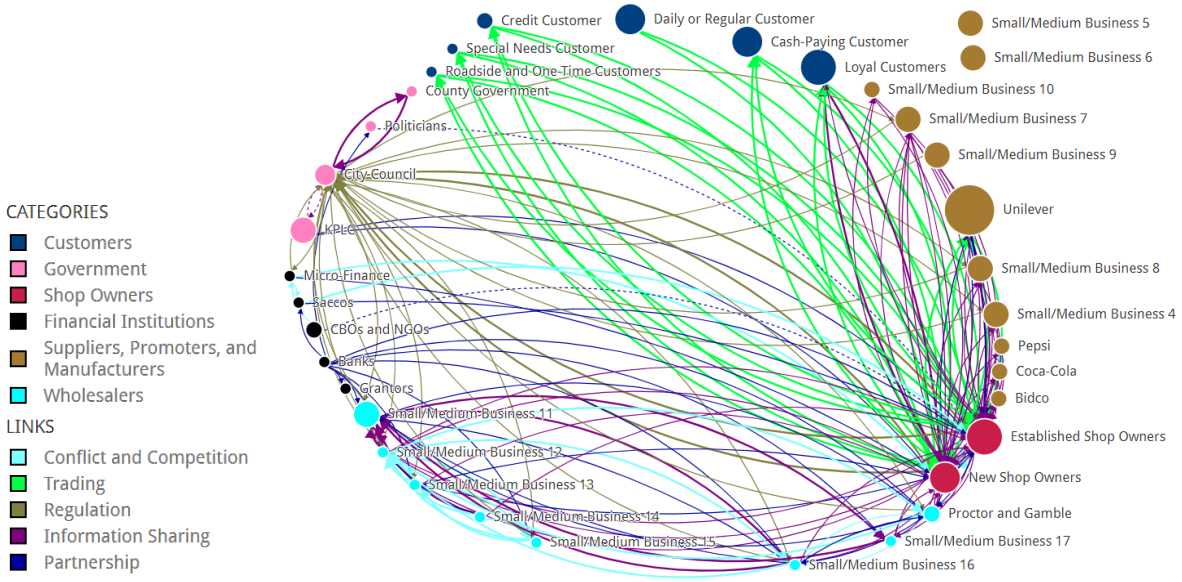

Figure 9: Net-Map of actors and linkages for participants who are new duka managers, from Kibera.

4.7.1 Actors

A majority of actors were suppliers, promoters, and manufacturers (11) and wholesalers (8). The map also showed that among all actors, Unilever as a supplier, promoter, and manufacturer, had the highest influence rating of eight on a scale of 0-8. Small and medium-sized businesses have been anonymized.

4.7.2 Linkages between Actors

A total of 172 links were identified by participants who had managed a duka for less than 6 years, including information sharing (67), and regulations and rules (25). Among these, 58 links were defined as strong, 110 were normal, and four were weak.

4.7.3 Influence and connections

In Figure 10 below, a matrix compares the number of connections of each actor (X-axis) with their influence (Y-axis). Results show that shop owners were perceived to have high influence and high connections. The red dots on the far right represent new shop owners (bottom), and established shop owners (top), On the other hand, financial institutions, wholesalers, and suppliers, promoters, and manufacturers had few connections and low influence. In this figure the city council, identified with a green square, was classified with a low level of influence and a high number of connections.

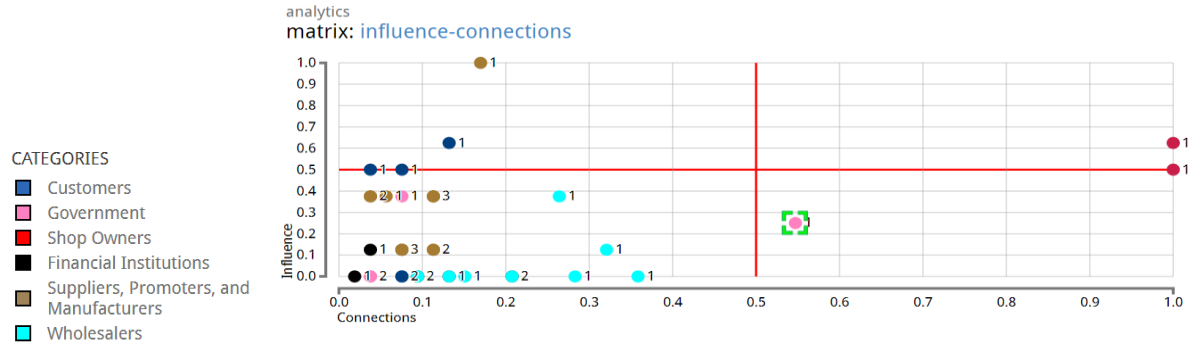

Figure 10: Influence-Connection matrix for participants who are new duka managers, from Kibera

Social network analysis metrics: Closeness and Betweenness

- Closeness: City council, new shop owners, established shop owners, banks, Small/Medium Business 16, Proctor and Gamble, Small/Medium Business 12, and Small/Medium Business 13 were closely linked to all actors in the network. The remaining actors shared the lowest closeness factor.
- Betweenness: City council and new and established shop owners had connecting roles by linking other actors that did not necessarily have relationships with one another. Twenty-six actors shared the lowest betweenness factor.

4.8 Kibera: Experienced Managers

The map below shows 37 actors and their linkages identified by new managers from Kibera.

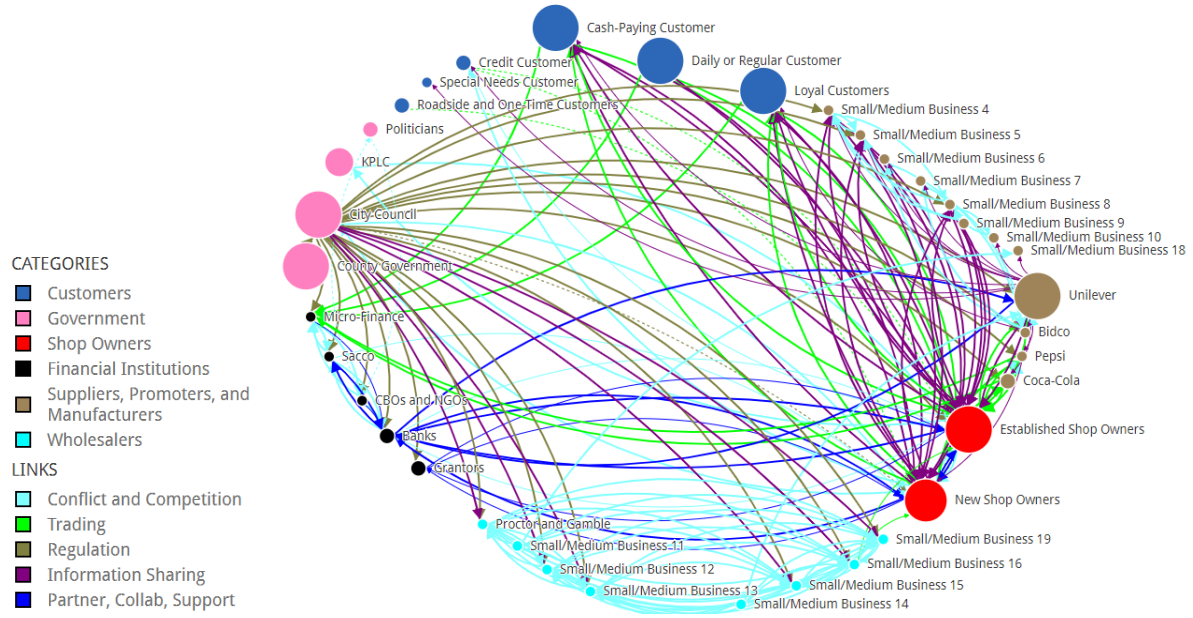

Figure 11: Net-Map of actors and linkages for participants who are experienced duka managers, from Kibera

4.8.1 Actors

Actors included suppliers, promoters, and manufacturers (12) and wholesalers (8). According to participants that were experienced managers, seven actors shared the highest `influence rating. The city council, county government, cash-paying customers, daily customers, loyal customers, established shop owners, and Unilever had the highest influence rating of eight on a scale of 0-8. Small and medium-sized businesses have been anonymized.

4.8.2 Linkages between Actors

A total of 191 links were identified by participants who were experienced duka managers, including conflict and competition (80) and information sharing (47). Of these, 156 links were defined as strong, 27 were normal, and eight were weak.

4.8.3 Influence and connections

Figure 12 below compares the number of connections of each actor (X-axis) with their influence (Y-axis). Results show that shop owners had high influence and more connections while suppliers, promoters, and manufacturers, and wholesalers had fewer connections and less influence (bottom left quadrant). In this figure, the city council, identified with a green square, has a high level of influence and a high level of connections. The red dots on the far right represents new shop owners (bottom) and established shop owners (top).

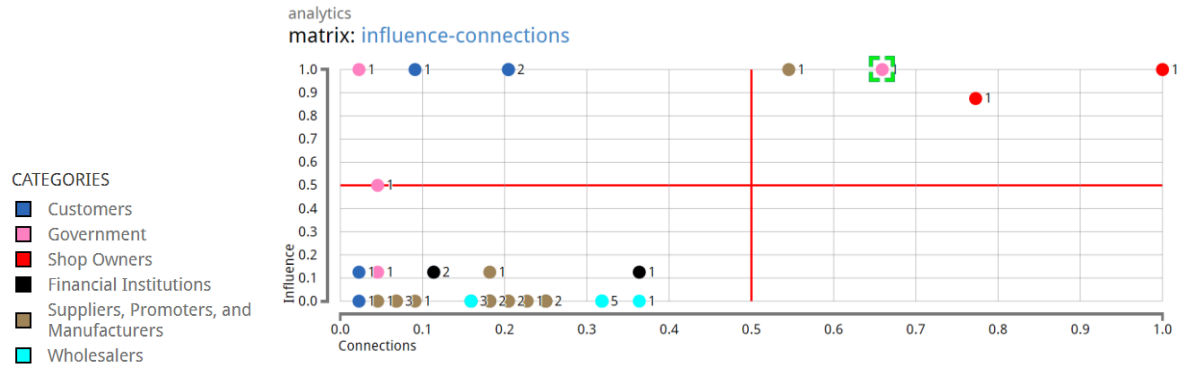

Figure 12: Influence-Connection matrix for participants who are experienced duka managers, from Kibera

Social network analysis metrics: Closeness and Betweenness

- Closeness: City Council, banks, and Unilever were most closely linked to all actors in the network. This network was close-knit with many close connections across actors. The remaining actors shared the lowest closeness factor.
- Betweenness: city council, established shop owners, new shop owners, and Unilever played the most important connecting roles by linking other actors that may not necessarily have relationships with one another. Twenty-one actors shared the lowest betweenness factor.

4.9 Kawangware: Experienced Managers

Figure 13 below shows a total of 37 actors and their linkages identified by experienced duka managers from Kawangware.

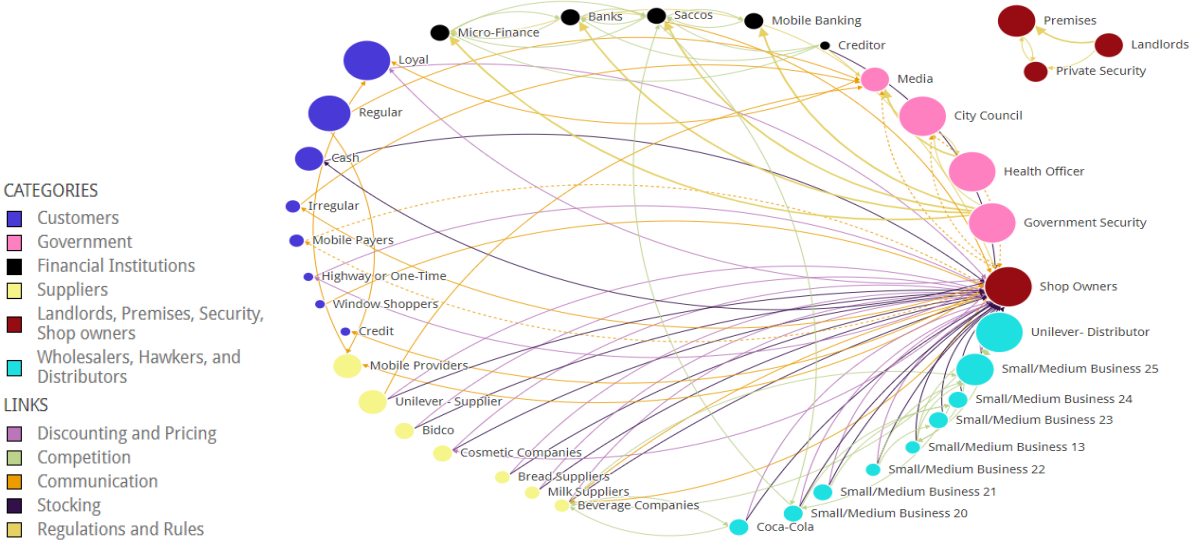

Figure 13: Net-Map of actors and linkages for participants who are experienced duka managers, from Kawangware

4.9.1 Actors

A majority were wholesalers, hawkers, and distributors (9), customers (8), and suppliers (7). Among all the actors, the city council, Unilever as a distributor, loyal customers, shop owners, government security, and health

officers, had the highest influence rating of eight on a scale of 0-8. Small and medium-sized businesses have been anonymized.

4.9.2 Linkages between Actors

A total of 95 links were identified by participants who were experienced duka managers, including competition (28), communication (18), and stocking (18). Six links were defined as strong while 84, normal, and five were weak. A clique, comprising actors responsible for securing neighborhood premises, private security, and landlords are influential in promoting the health role of duka managers but are not connected to the larger network of actors.

4.9.3 Influence and connections

Figure 14 below compares the number of connections for each actor (X-axis) with their influence (Y-axis). Results show that experienced managers from Kawangware perceived almost all actors to have few connections: Shop owners - the Net-Map participant's peers - were the only actors classified as having high influence and high connections. Most wholesalers, hawkers, distributors, and all financial institutions had fewer connections and less influence. The city council, identified with a green square, had a high level of influence but a few connections. The two dots to the right of the city council represent Unilever (light blue) and shop owners (dark red). Experienced managers from Kawangware did not classify any actors as highly connected with low influence.

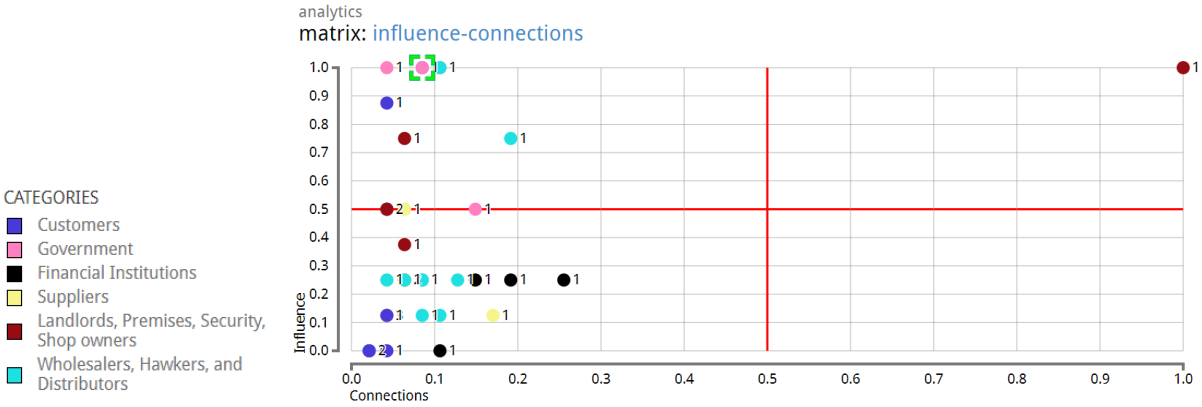

Figure 14: Influence-Connection matrix for participants who are experienced duka managers, from Kawangware

Social network analysis metrics: Closeness and Betweenness

- Closeness: City council, loyal customers, media, SACCOs, creditors, shop owners, and Small/Medium Business (20) were closely linked to all actors in the network. Relative to those listed above, the other actors shared a similar and lower closeness factor.
- Betweenness: Shop owners and SACCO had connecting roles by linking other actors that did not necessarily have relationships with one another.

4.10 Kawangware: New Managers

Figure 15 below shows 38 actors and linkages identified by new managers of a duka, from Kawangware.

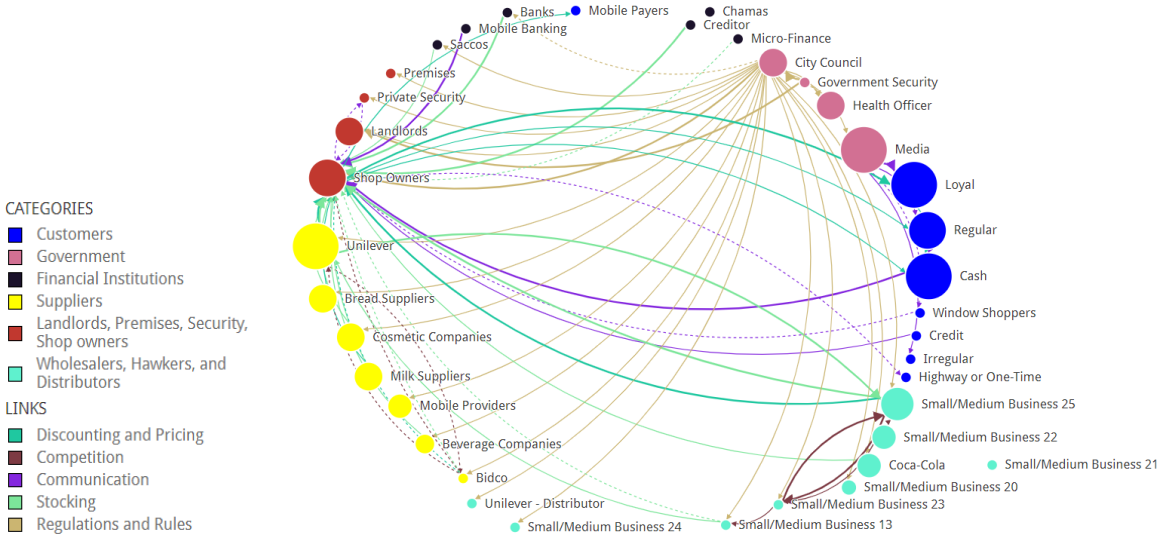

Figure 15: Net-Map of actors and linkages for participants who are new managers of a duka, from Kawangware

4.10.1 Actors

A majority of actors were wholesalers, hawkers, and distributors (9), customers (8), and suppliers (7). Among all the actors, the city council, cash customers, loyal customers, media, and Unilever as a supplier had the highest influence rating of eight on a scale of 0-8. Small and medium-sized businesses have been anonymized.

4.10.2 Linkages between Actors

A total of 64 links were identified by new managers from Kawangware, including regulation and rules (24) and stocking (15). Among these, 16 links were strong, 33 were normal, and 15 were weak.

4.10.3 Influence and connections

Figure 16 below compares the number of connections of each actor (X-axis) with their influence (Y-axis). Results show that shop owners (red dot in the right quadrant) had high influence and more connections, while suppliers, wholesalers, hawkers, and distributors had fewer connections and less influence. The city council, identified with a green square, had a moderate level of influence and a high number of connections.

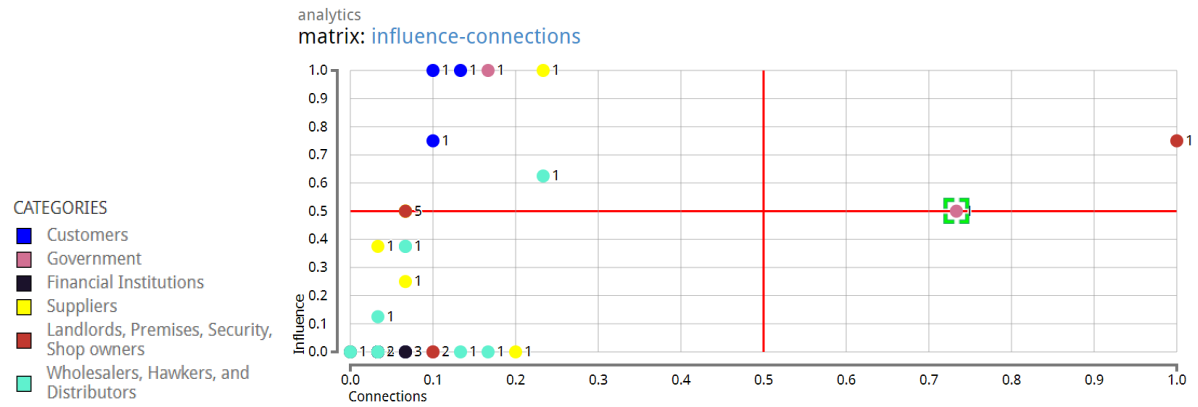

Figure 16: Influence-Connection matrix for participants who are new duka managers, from Kawangware

- Social network analysis metrics: Closeness and Betweenness
- Closeness: City council, Unilever, Small/Medium Business 13, and shop owners, Small/Medium Business 25, were most closely linked to all actors in the network. This network was close-knit with many close connections across actors. Chamas and Small/Medium Business 21 had the lowest closeness factor while regular customers, saccos (credit cooperatives), shared the next to lowest closeness factor.
- Betweenness: City council and shop owners, played the most important connecting roles by linking other actors that may not necessarily have relationships with one another. Twenty-nine actors shared the lowest betweenness factor.

Table 7: Summary of Net-Map results for actors, connections, perceived influence, and connectedness, by study site

UJoin				
	Kibera		Kawangware	
	New Managers	**Experienced Managers**	**New Managers**	**Experienced Managers**
# Actors	36	37	38	37
# Connections	172	191	64	95
High Influence and Many Connections	Shop owners	Shop owners	Shop owners, City Council	Shop owners
High Influence and Few Connections	Customers Government	Customers	City Council	None
Low Influence and Many Connections	City Council	None	None	None
Low Influence and Few Connections	Financial Institutions, Wholesalers Suppliers, Promoters, Manufacturers Customers	Suppliers, Promoters, Manufacturers Wholesalers Financial Institutions	Suppliers Wholesalers Hawkers Distributors	Wholesalers Hawkers Distributors Financial institutions

5. Discussion

Net-maps were created by members of two initiatives, UAfya and UJoin, residing in two informal settlements, Kibera and Kawangware, in Nairobi, Kenya. The results are discussed for each program and study site, with emphasis on similarities and differences in actors and linkages.

5.1 UAfya

Among communities of shoppers in Kawangware, a larger number of actors (average of 30) were identified compared to Kibera (average of 25). The groups in Kawangware also identified a significantly larger number of links (average of 167) compared to Kibera (average of 88). The number of links perceived as strong was also much higher in the maps completed by participants in Kawangware (average of 93) compared to the maps completed by participants in Kibera (average of 46). The results show that Kawangware is a tighter and stronger community for business and relationships. This may be a result of economic agency as Kawangware residents have slightly higher income and possibly more economic relationships and transactions.

In both Kibera and Kawangware, the younger participants identified far fewer perceived connections than older participants. It is noteworthy that in Kawangware, the younger participants perceived there were more connections than the older participants in Kibera. The older participants in Kawangware and Kibera shared more background about actors, explained arguments for drawing links, and provided more rationale for rating actor influence and alignment than the younger participants. This is not surprising given they have more experience to share, and have more, and older, children.

5.1.1 Highly influential and well-connected actors

In both locations family and friends were perceived to be highly influential and closely connected. Business companies, community institutions, and media also were highly influential and well-connected actors in Kawangware, however in Kibera, it was health practitioners and media type actors who had this classification. This is not unexpected as the UAfya initiative is a health-focused program with family-related themes for new and young mothers. During pregnancy and childcare, family and health workers have a more prominent role in the lives of new mothers and are potential influencers of knowledge and behavior. Younger participants from Kibera identified the media as having high influence and many connections. This is not unexpected as media is an important source of information, entertainment, and social networking among youth globally today.

Schools and teachers were generally considered to be highly influential and well connected. School personnel, especially teachers but including athletic coaches and other support staff, were considered highly influential and highly connected, especially with the girl child.

In contrast, older UAfya participants from Kibera identified the health practitioner as an influential and connected actor. It may be that older participants have already made connections with health workers since Kibera has been a major target of development and philanthropic interventions while Kawangware has not.
It was also noteworthy that actors belonging to formal institutions such as government officials and teachers were perceived to have higher levels of influence, while in contrast, midwives and traditional healers had contact with many UAfya members, but were assigned a low level of influence.

5.1.2 Highly influential actors with few connections

Social communities and community institutions, such as CBOs and NGOs were perceived to be highly influential actors with few connections, however, this result differed by study site and age. Specifically, this result was endorsed by participants from Kawangware and among older participants from Kibera. Younger UAfya participants from Kibera identified health practitioners as having high influence but few connections, and this may perhaps reflect their own needs and priorities as young and pregnant mothers-to-be, to make connections with health workers. This finding may also be in part influenced by personal experiences with outreach work in the community, or that younger individuals in Kibera do not see value in connections between health and business communities.

Nonetheless, this is an important finding that shows community institutions for business and health may be valued by some UAfya members and implies also that there may be untapped potential for these actor types to influence behaviors of community members. Perceptions of poor community connections with health practitioners and community institutions may be translated into a need for the UAfya community in Kibera.

5.1.3 Well-connected actors with low influence

Older participants in Kawangware perceived that the government was well-connected but lacked influence within the community, while younger participants from Kibera identified community institutions as being connected but uninfluential. This finding may underlie a credibility issue with community-based organizations among younger individuals in Kibera and warrants further exploration to support the development of positive community attitudes towards business groups that may be established in the future to support local entrepreneurs. One issue may be the lack of sustainability of community institutions. Another aspect could be "poverty tourism" in Kibera where outsiders and their programs come and go frequently. The youth, unlike their parents, may feel that accepting the narrative of these outside groups is undignified; they do not want to be labeled as 'hopeless' and in need of foreign handouts.

5.1.4 Unconnected actors with low influence

Actors in this category are disengaged from the UAfya community, and for both study sites, included government entities, business partners, and some NGOs. These actors included the Chamas (women's groups) who seldom talk about health issues, and spouses who were conspicuously absent from the maps. There were different views about the level of influence of Mama Mbogas (informal vegetable sellers) and their alignment with UAfya goals. However, they were frequently discussed in relation to the creation of the maps and could be engaged to further TRANSFORM goals. Safety issues in some sections of the Kibera community may underlie decreased penetration and visibility by the business community and business support companies, in turn, limiting opportunities for community interactions with vendors, and supporting companies.

5.2 UJOIN

The communities of shopkeepers in Kibera and Kawangware are similar in terms of the average number of actors identified (37.5 in Kawangware and 36.5 in Kibera). However, the average number of links perceived as strong was much higher in the maps completed by participants in Kibera (107) compared to the maps completed by participants in Kawangware (22). While shoppers (UAfya) in Kawangware were more close-knit than their counterparts in Kibera, a similar observation was not found among shopkeepers (UJoin) in Kawangware. This may be due to the physical proximity that shopkeepers have with one another in Kibera. In Kibera, there is a greater tendency for shopkeepers to rely more on each other, and borrow stock from each other, co-operate on delivery of stock, and help each other apply for permits. This leads to increased interaction and co-operation that strengthens social bonds and relationships.

In both Kibera and Kawangware, UJoin groups that had been managing a duka for a longer period provided more depth about the actors, links, influence, and alignment than the younger segments. This is not surprising given they have more experience to share.

5.2.1 Highly influential and well-connected actors

The UJoin participants overwhelmingly perceived that their peers were the most influential and had the most connections. The perceptions ascribed to established and new shop owners combined with the relative absence of other actors with similar levels of influence suggest that the best way to spread behaviors in the UJoin community is from within their tight-knit network using early adopters and change agents.

5.2.2 Highly influential actors with few connections

The local government, especially the city council, was generally perceived to be more influential and have more connections. They deal with regulation and are positioned to influence behavioral matters related to health. Overall, the local government officials, including the Nairobi city council, health officers, and officials who regulate the commerce and the media, were rated as highly influential and have a high number of connections. This presents significant room for the city council to enhance work that provides policy or regulatory support to give dukas credibility as health agents.

Unilever is widely respected because they share information about the products they sell. Other manufacturers do not offer the same level of service. Manufacturing companies, especially Unilever, were consistently recognized as providing important health information about the health products they sell. Engaging other manufacturers to adopt similar practices would be welcome to the duka community.

5.2.3 Well-connected actors with low influence

Only one group (new managers in Kibera) identified an actor (the city council) who was well connected but who had low influence. This may be that newer managers are not yet experienced in their role to recognize how the city council may influence commerce. Alternatively, the city council may spend less time and give less attention to newer managers when compared to experienced managers. In this scenario, low levels of recognition between the two groups create a vicious cycle.

5.2.4 Unconnected actors with low influence

Managers from all four groups listed similar actors as having low influence and low connections. These actors included wholesalers, suppliers, distributors, who - with the exception of Unilever - were perceived to spend little time explaining the features of products that could improve customer health, with managers. Another actor that was frequently mentioned in this quadrant was financial institutions; financial institutions may be viewed negatively to reflect the difficulty of obtaining business loans and credit.
Comparison of group results

6. Recommendation

UAfya and UJoin have different goals and, by and large, the participants representing these initiatives discussed different actor types and actors when it came to who influenced decisions around healthy behaviors. An exception is the inclusion of government/city council in the maps created by both UAfya and UJoin groups. Despite being the only common actor/actor type, the two participant groups assigned government and city council different levels of influence and numbers of connection (Tables 4 and 7). This speaks to the importance of government/city council but also suggests a gap in perceptions relating to the relationships that government actors have with the businesses they help regulate.

The implications of the results for further research and for programs and policy are discussed in this section.

6.1 Recommendations for programs

The influence and connection matrices were assessed with existing knowledge in mind. Therefore, actors who had the highest scores – those furthest to the top right corner – were not automatically proposed as actors to engage with. These actors may have been either too vaguely defined (as in the case with friends and family or media in the UAfya maps) or already highly engaged (such as established dukas in the UJoin maps).

Recommendations are organized according to general categories identified in a related literature review and case study series of micro-enterprises using digital communities to promote healthy behaviors. The five categories for scaling are competitiveness, collaboration, communication, capacity, and capability.

When considering competitiveness, we found that the City Council is highly influential but that dukas are not perceived as credible health agents. Our recommendations based on these findings are to help the City Council bridge untapped potential as a health system enabler. This could be done through the exploration of policy or regulatory tools.

In collaboration, we found that teachers are overlooked actors and they have credibility but they are not well connected to health actors. We recommend establishing a link between teachers and health providers. We also suggest leveraging teachers' influence on kids. In these communities, parents often send their kids to buy small items from dukas. Programs that support and increase the capacity of younger participants to develop efficacy to forge more and tighter linkages with other actors and services for the benefit of their business is also recommended. These may include peer-to-peer mentoring programs and opportunities to collaborate with and learn from more experienced peers, to increase skills and efficacy among younger duka owners. Strategies to improve working relationships with institutions that support micro-enterprise, especially financial institutions, and wholesalers, also is needed. In addition, government entities and sectors, including city council, had high influence but low linkages with the community of duka owners. Improving perceptions and image of government actors and providing opportunities for positive engagement and successful endeavors with the duka owners may be beneficial to integrating duka enterprises into mainstream retail activity and for sustaining scaled-up programs.

In communication we found that UAfya and UJoin members have knowledge they are willing to share with each other. We also found that there was limited consensus on what UAfya and UJoin means. Our recommendation is to amplify UAfya and UJoin brand identities and communication strategy. Leveraging the role of the media in promoting brand identity may be attractive to younger dukas managers/owners who engage more with media channels. Communication about products was limited between distributors and the dukas. Only one distributor provided education and messaging guidance that the retailers could be pass on to the consumer.

In capability we found that UAfya and UJoin have varying or value propositions. Prioritizing key opportunities on the consumer path from poverty to prosperity will likely be an attractive proposition for members of these groups, in turn garnering interest and increased engagement with platforms.

These recommendations support the vision for scale-up of the UJoin and UAfya programs: accreditation and branding of a novel type of duka, who is trained and knowledgeable, and provides high-quality services that includes training to meet basic health information needs of patrons. This accredited duka would foster a new type of retailer that provides basic health information to improve customer health while also selling more health products and benefiting the bottom line.

6.2 Recommendations for further research

To our knowledge, this is the first study to identify and examine who influencers duka owners' business practices. Additional social science research may provide more detailed insights on the nature of the relationships identified in this study. The individuals and linkages participants identified have the potential to be leveraged to strengthen new programs such as broader interventions to support micro-retailers and new mothers. For instance, qualitative studies to increase understanding of the factors influencing the role of health workers in the community will be important to a program aiming to use dukas as health advocates. Qualitative research might further explore why some actors with perceived high influence are poorly connected within the community of dukas and young mothers, and why government entities have low influence and connections with this community. Results may provide valuable insights for salient and culturally appropriate program design. Strategies that support access to, and networks with these actors, may strengthen the UAfya and UJoin communities.

Lastly, additional research among the larger population of micro-retailers, and that uses random sampling processes to support generalization of findings, may also both validate and expand on these findings, and make program strategies more applicable to the larger group of micro-retailers in Kenya.

6.3 Recommendations for policy

For the construct of capacity, it was surprising to find that duka owners receive health information from their customers. Developing a government credential program to help build duka owner credibility as health information agents in their communities. It may also be beneficial for increasing knowledge and promoting positive health behavior change in underserved communities. Policies that encourage intersectoral collaboration social enterprise initiatives with duka owners such as joint ventures between the business, health, youth development, and education sector will be beneficial in synergizing the potential contributions of duka owners to education and health activities in their communities.

7. Limitations

While the results have provided several useful findings for scaling up programs for micro-retailers, they should be interpreted in consideration of the following limitations.

First, the purposeful convenience sample, while theoretically sound, precludes the ability to generalize the results beyond the two communities and to the wider population. It is possible that other micro-retailers who were not invited to participate or those who refused to participate in the activity, may have different demographics, perceptions, connections, and experiences from those who did participate. In addition, the results are limited to the duka owners that are registered with UJoin and UAfya rather than the larger community of duka owners.

Second, the results are based on self-reported perceptions and experiences that may be subject to recall and social desirability biases. The participatory process, member differences within groups, and group dynamics to derive the maps may also have influenced participant responses and introduced bias. Nevertheless, precautionary measures implemented during field work to ensure that participants felt comfortable within groups to provide objective responses, such as disaggregating groups by sex and age, and objective moderation of the group work, likely minimized the risk for these biases.

8. Conclusions

A net map activity was conducted among members of the UJoin and UAfya digital platforms in Nairobi Kenya, with the aim of exploring and understanding potential frameworks for establishing digital-based community-driven partnerships with the private sector for health promotion through behavior change. Results showed that there are various actors that influence UAfya and UJoin platform members, and the level of influence and connectedness varies by age, sex, and experience (with business and motherhood) of program beneficiaries. Gendered approaches may be needed to tailor digital program design to the needs of different sub-groups using digital innovations. The results also showed that duka owners are connected to actors with potential to build their capacity to promote healthy behaviors in their communities in the course of their daily business activities. When scaling-up digitally-based knowledge, capacity-building, and support programs, planners must understand the perspective of the audience in terms of who the key actors are that support them on a daily basis, perceived influence of different actors, factors that connect the audience to actors, each other, and to program services, as well as what hampers relationships and connections.

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Knowledge Management from Senior Users of Online Health Information Point of View

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Abstract: In today's society, all citizens who need digital information to manage their everyday life must be able to access it and trust it. They should have enough knowledge to use information and communication technologies (ICTs) and online health information (OHI) in an intended and purposeful way. The broader aim of this paper is to present and discuss health knowledge management (KM) from senior users of the online health information point of view. The theoretical point of departure is based on an understanding of health, knowledge and the Internet as social practices. This paper investigates e-Health literacy (eHL) and KM in health amongst seniors aged 65-90. It presents a case study on how they access, apprais, share and apply OHI in comparison to the way they use face-to-face health-encounters. Data comes from 17 open-ended interviews. E-HL and KM concepts are used to analyse and describe online behaviour and knowledge management in health as an interplay between individual and social factors. The results show how participants engage in self- and co-management of their own or others' health and illustrate how they get or receive help to understand OHI. By examining how they use ICT and do (not) trust OHI regarding "serious cases," this paper provides critical insight into ways seniors acquire information and how they appraise, understand or trust in it. Their information-seeking activities are performed mainly in private settings, seldom with professionals. They have lower levels of trust in their own, individual appraisal skills, compared to collective searches and discussions. Norwegian seniors are cool and pragmatic, and emphatic on the "when needs must, see your GP!". By examining differences in ICT use, knowledge acquisition and support given or received, the results pinpoint how providers must affirm seniors' ICT use and individual and collective online health behaviour as assets for healthy ageing. A potential barrier for citizens' use of OHI and health technology is the built-in understanding of health as an individual capacity and ICT use as an individual activity, compared to a contemporary understanding of health and the Internet as social practices and collective resources. Designers of health technologies and OHI should critically consider built-in understandings of content and users to enhance accessibility and value for citizens of all ages.

Keywords: healthy ageing, knowledge management, e-health literacy, online health information, knowledge sharing, social practice

1. Introduction

The global trend towards longevity is followed by efforts towards healthy ageing and ageing in place, i.e. at home (Stephens, 2017; Wiles et al., 2011). Digitisation and health technology are suggested as appropriate response to expected societal changes (Wagner, Hassanein and Head, 2010). Key drivers towards digitalised societies, e.g. the rapid development of health technology and the political and structural processes towards self-management of health, exercises a pressure on citizens to find, critically appraise and use digitized knowledge and health technology individually or collectively. This paper investigates how a group of Norwegian seniors aged 65-90 managed their own and others health through online activities, and how they create, share and use online health information.

The aim of this paper is to present and discuss health knowledge management (KM) from senior users' of online health information point of view. The theoretical point of departure for this paper is based on an understanding of health, knowledge and the Internet as social practices. Accordingly, the concepts e-health literacy and KM need to be elaborated and discussed in relation to healthy ageing.

The structure of the paper comprises the following sections. The introductory section presents the setting for health KM and online health information; healthy ageing, e-health literacy and KM in a general health context. The second section presents the research methodology, the qualitative interview design and participants, and analytical strategies. In the third section, the empirical material is presented and illustrated with quotes from

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the participants. The last two sections comprise discussions and offer conclusions and suggestions for health technology developers, health care workers, and further research.

1.1 Healthy ageing

Life expectancy is increasing globally (World Health Organization, 2017b). The ability to make healthy choices build on a complex set of skills and competencies, e.g. knowledge about your own body, nutrition, activity, symptoms or diseases, and how healthcare services are organised and accessed (Levesque, Harris and Russell, 2013b). Healthy ageing and longevity are related to how individuals and groups choose, adapt and co-/self-manage in the face of social, physical and emotional challenges (Huber et al., 2011). The combination of longevity and digitization of health services have raised concerns about evolving digital divides (World Health Organization, 2016; Friemel, 2016; Hall et al., 2015; Rhoades et al., 2017) and digital exclusion in later life (Matthews, Nazroo and Marshall, 2018; Tennant et al., 2015; Silver, 2015; Kickbusch, 2001). Digital proficiency in online health information activities demands a minimum of socio-material resources (e.g. ICT equipment, electricity, Internet access), bodily capacities (e.g. cognition, hearing, sight, dexterity) and knowledge and executive functioning (understanding, analysing, decision-making) (Weck, Helander and Meristö, 2020). In many cases, especially in these Covid19 times, not mastering digital information might lead to social isolation and mental health problems (Gerst-Emerson and Jayawardhana, 2015; Armitage and Nellums, 2020). Citizens, as patients, are expected to find and engage with online health services, e.g. booking appointments, ordering prescriptions, or sharing electronic health records (EHRs).

Healthy ageing presupposes possibilities to take part in physical and social activities, and to be able to exercise agency and citizenship rights and duties. Rowe and Kahn introduced the concept of healthy ageing to denote the common denominators they found to be positive for longevity, i.e. minimizing the risk of disease and disability, maintaining physical and cognitive well being and continuing the engagement in social life (Rowe and Kahn, 1997). Several authors have criticised their concept for being too individualistic and biased towards the western ideology of well-being and individual happiness. Their first attempt at defining successful ageing were also critiqued for offering a top down definition of longevity and well-being, ignoring individual and contextual factors (Bowling and Dieppe, 2005). Row and Kahn (2015) have complied with some of this critique in their second version of successful ageing. They suggest that their model is better used as a resource, not as a receipt, influenced by an overall perspective considering e.g. cultural, societal factors, institutional structures, life course, and various biometrics. Stephens (2017) has suggested that the focus should be on capabilities, which focuses on possibilities for learning and growth. Our study illustrates how being able and willing to engage in digital KM as part of healthy and active ageing is all about capabilities – own, others or societal.

1.2 E-Health literacy

In an ageing world, healthy ageing and longevity are related to how individuals and groups use available health-related resources to make healthy decisions, to adapt, and co-manage or self-manage in the face of social, physical, and emotional challenges (Huber et al., 2011). All citizens should have the opportunity to make healthy choices and be knowledgeable about their own body, nutrition, physical activity, symptoms, or diseases and know how health care services are organized and accessed (Levesque, Harris and Russell, 2013a). However, todays seniors' knowledge about health or health care systems is a composite of what they learned through their lifetime, which may be outdated or no longer valid due to re-organisation of the healthcare systems. Acquisition and appreciation of current and valid health-related skills and knowledge presupposes lifelong learning and particular skills and competencies. Contemporary health resources are digitised, and seniors are expected to master health related technology, i.e. be e-health literate.

Knowledge acquisition in a digitised society is related to digital proficiency in online health information activities, access to digital technologies and the Internet, bodily capacities (e.g. cognition, hearing, sight, dexterity), and knowledge and functioning (understanding, analysing, decision-making). This paper builds on a study of how a selected group of Norwegian seniors between 65-90 years use ICT to access, appraise and apply online health information (OHI), and how they evaluate this information compared to face-to-face health-encounters.

The combination of longevity and digitisation of health services has raised concerns about evolving digital divides (World Health Organization, 2017a; Friemel, 2016; Hall et al., 2015; Rhoades et al., 2017) and digital exclusion in later life (MatthewsNazroo and Marshall, 2019; Tennant et al., 2015; Kickbusch, 2001; Silver, 2015). Responding to this concern can be challenging: *"Despite the significance of this phenomenon, the information systems (IS) literature lacks a comprehensive consideration and explanation of technology acceptance in general*

and, more specifically, Internet adoption by the elderly." (Niehaves and Plattfaut, 2014). There are many influencing factors based on societal, individual, or technological differences. This divide may manifest differently in different countries (NishijimaIvanauskas and Sarti, 2017) based on individual characteristics (Van Deursen and Helsper, 2015) or, for example, the national features of the used OHI system (Wang et al., 2008). Since OHI is beginning to be not only a right but also an opportunity to contact healthcare services, exploring attitudes towards it is necessary both, for democracy, but also to achieve accessible healthcare for all. Citizens in western countries, as patients, are expected to use ICT and to find and engage with online health services, e.g. booking appointments, ordering prescriptions, or sharing electronic health records (EHRs). Several authors are worried about using EHRs whitout anchoring it with different professionals and patients (Wiljer et al., 2008; Zurita and Nøhr, 2004; Goroll, 2017; BossenChen and Pine, 2019). As an example, Hemsley et al. (2018) argue that electronic personal health records (e-PHR) exert new demands on patients and health care service providers e.g. cognitive capabilities, education, ICT literacy, and willingness to share health information. They warn that high literacy demands on e-PHR is a potential threat to health outcomes.

Contemporary framing of e-health literacy (eHL) departs from Nutbeam's (2008) seminal research, which showed a connection between literacy skills and health status, i.e. health outcomes. His Lily model, with 6 petals, refers to different literacies: traditional (reading, writing, calculating), computer, media, science, information, and health and health services. The Lily model has been criticised for ignoring socio-economic factors, context and individual and group-based differences. Several scholars have attempted to amend or create a new model of eHL, making a plethora of definitions available (Gilstad, 2014; Bautista, 2015; Nørgaard et al., 2015; Griebel et al., 2018).

Gilstad (2014) offers an amendment to Nutbeam's Lily model (see Figure 1.), and a new definition of eHL: *eHealth literacy is the ability to identify and define a health problem, to communicate, seek, understand, appraise and apply eHealth information and welfare technologies in the cultural, social and situational frame and to use the knowledge critically in order to solve the health problem.* (Gilstad, 2014).

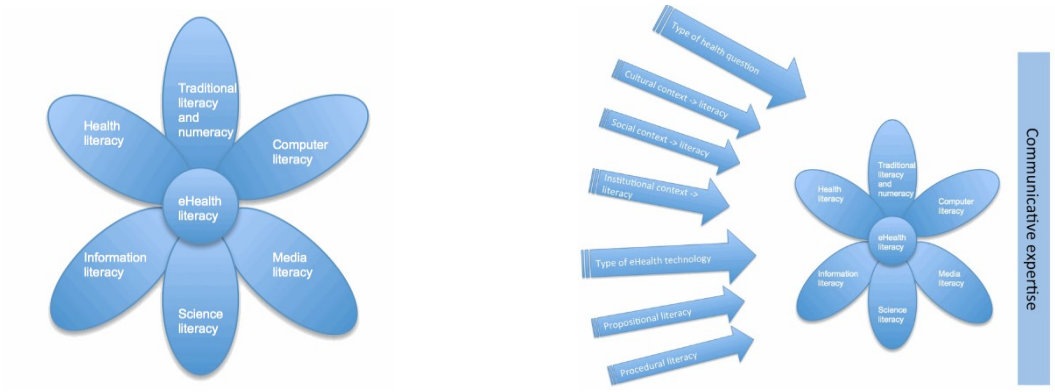

Figure 1: The left side shows Nutbeam's Lily model and the right side Gilstad's amendment with contextual factors influencing eHL and the communicative expertice (from Gilstad (2014). Permission to reprint the figue is obtained from the rightsholder

Nørgaard et al. (Nørgaard et al., 2015) propose an eHL-framework, which focuses on individual's and population's capacity to understand, use and take benefit from technology to promote and maintain their own health (see Figure 2.). The interaction between an individual's ability to process information and engage in their own, personal health and system requirements (accessible and suitable systems) gives the individual a sense of safety and control, and motivation to engage in digital services. Their framework is composed of seven domains (Nørgaard et al., 2015):

1. Ability to process information
2. Engagement in own health
3. Ability to engage actively with digital services
4. Feeling safe and in control
5. Motivation to engage with digital services
6. Having access to systems that work
7. Digital services that suit individual needs.

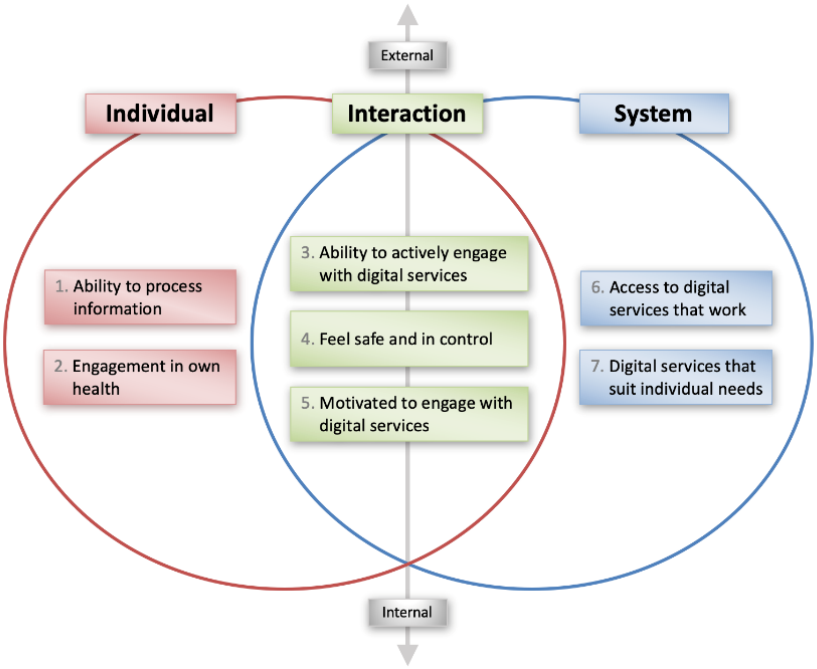

Figure 2: Nørgaard et al. model from 2015, grouping necessary issues and illustrating as necessities for seamless interaction. Permission to reprint the figure is obtained from the rightholders.

Bautista (2015) suggests that quality of life should be considered in the updated definition of eHL: "eHealth literacy involves the interplay of individual and social factors in the use of digital technologies to search, acquire, comprehend, appraise, communicate and apply health information in all contexts of healthcare with the goal of maintaining or improving the quality of life throughout the lifespan."(Bautista, 2015).

Griebel et al.'s (2018) "viewpoint paper" is an interesting contribution to many discussion of eHL. It calls for further updated definitions of eHL, for utilizing standardised measurements tools, for justification of new research by critical appraisal of state of the art, for an approach to eHL that is relevant throughout the lifespan, for considering eHL concerning technology design, constraints or acceptance, and providing guidelines for developers (Griebel et al., 2018).

Two recent contributions to the body of knowledge on eHL can also be mentioned to illustrate the increasing interest in eHL and online health information (OHI). The title of Diviani et al.'s (2019) study of how adults (aged 18-65) relate to OHI is telling: "Where else should I look for it?" OHI is always available for individual or group-based searches and discussions. Magsamen-Conrad et al. (2019) are finding support with the same argument – technological and health literacy is a collaborative practice with tech-savvy doers, watchers, teachers, and learners. This collaborative practice enables people to access, analyse, and share OHI. As has been shown above, health literacy is an essential social determinant of health and should not be reduced to an individual risk factor. Interestingly, Papen (2009) suggested more than a decade ago that literacy can be understood as a social practice, as is the Internet. This illustrates a point made by Griebel et al (2018) in their conclusion that existing knowledge often was ignored. It is also worth noting that the practice and research fields of KM and e-health are brought together less frequently than expected.

1.3 Knowledge management in a health context

WHO launched their KM strategy in 2005. The mission of WHO Knowledge Management (WHO-KM) is to help bridge the "know-do gap" in global health by fostering an environment that encourages the creation, sharing, and effective application of knowledge to improve health (World Health Organization, 2005).

KM is a set of principles, tools and practices that enable people to create knowledge and to share, translate and apply what they know to create value and improve effectiveness (World Health Organization, 2005). The WHO-KM strategy focuses on national policy-makers, WHO programmes, and health professionals. The objectives of the strategy lie in three main areas – strengthening country health systems through better knowledge

management, establishing KM in public health, and enabling WHO to become a better learning organisation, through the following strategic directions:

1. Improving access to the world's health information
2. Translating knowledge into policy and action
3. Sharing and reapplying experiential knowledge
4. Leveraging e-Health in countries
5. Fostering an enabling environment

The concept of KM is contested and difficult to pin down. Abell and Oxbrow (2006) offer an example of this when they state that "knowledge management (KM) is like beauty – in the eye of the beholder. There is no universally accepted definition of the term, perhaps reflecting its essential character, its unique interpretation by the organisation that adopts the philosophy" (Abell and Oxbrow, 2006; Maceviciute, 2002). To Maceviciute (2002) this makes the concepts useless. The Girards mapped the terrain in 2015 and demonstrated the depth, breadth, and international nature of KM. According to them, their work is the first attempt to catalog, within the academic literature, KM definitions, especially those with an applied orientation (Girard and Girard, 2015:2).In their KM-catalog, the four most common verbs were: use, create, share, and manage, and the four most common nouns were: knowledge, process, organization, and information. When they considered the words that appear at least 30 times, they offered the following definitions of KM (Girard and Girard, 2015:14):

- KM is the process of creating, sharing, using and managing the knowledge and information of an organisations.
- KM is the management process of creating, sharing and using organisational information and knowledge.

For the purpose of this paper, it is interesting to see how KM is defined as a social and collective process of collecting and creating a body of knowledge and a process of using this to connect to peers or organisations (e.g. health services). KM in health is also related to decision making and decision support, and abilities and willingness to use health technologies, as demonstrated by (WeckHelander and Meristö, 2020).

2. Methodology and participants

This study sits in a qualitative sociological tradition (Silverman, 2015). Data is produced through open-ended interviews with 17 participants aged 65-90 years. Eligible participants were home-dwelling adults above 65 years, able to read, hear and communicate in Norwegian without specialized equipment or interpreters. Participants were strategically recruited through snowballing and gatekeepers, e.g. through participants in the previous study (Fredriksen and Sudmann, 2016), research colleagues, health care personnel, neighbours, senior communities, or church services (the city mission and the state church). Participants were recruited from rural and urban municipalities, i.e. small and medium-sized municipalities and large cities. The strategic inclusion of participants allowed us to pay attention to, and secure variation in age, gender, rural/urban place of residence, and education as far as possible, taking into account the extensive changes in the educational system in Norway during the 20th century. Vocational education and training used to be an integrated part of working life in Norway, which makes it difficult to convert previous educational attainments to modern day educational system with basic, secondary, further, higher or post-graduate education (cf. the Bologna process and European higher education).

Participants received printed and e-mailed information from the gatekeepers and received the same information from the researchers after consenting to being contacted. All participants gave oral and written consent to participation and received text messages, e-mails or phone calls before interviews to confirm appointments with the researchers. Recruitment continued until saturation of the material.

Participants from two rural and two urban municipalities in Norway were included (nine men and eight women), see table 1. Educational attainment, converted to current levels of education, are shown in Table 2. All participants had completed continuous education which is not done justice to in table 2. They used ICT (information and communication technology) from one to three hours a day, on up to seven gadgets (e.g. phone, watch, tablet, laptop, stationary PC, smart TV, gaming console) which were used for different purposes. All participants are Caucasian middle-class Norwegian citizens, as are the researchers.

Interview venues were optional (e.g. private homes, offices, cafes, activity centres). The interview guide included prompts for OHI ("How would you go about to find OHI about an athlete's toe or a swollen finger?") to lessen the risks of ethical violations of privacy/personal searches. Some suggested practical demonstrations, others were solicited to demonstrate how they used their preferred device. The interviews lasted 45-90 minutes. They were performed by three of the authors 2017.

Table 1: Participant's age and gender

Age Gender	65-69	70-74	75-79	80-85	85+	No
M	4	5	0	0	0	9
W	3	0	2	2	1	8

Table 2: Participants educational attainments

Education Gender	Basic 1-10 years	Eq. high school 1-3 years	Graduate 1-4 years	Post grad. 4+ years
M	3	1	3	2
W	3	1	0	4

Interviews were summed up immediately. A written abstract with key points was shared among the researchers the same day, and adjustment or amendment to the interview guide was made immediately, if necessary. Interviews were professionally transcribed and imported into Nvivo11 (Nvivo qualitative data analysis software, 2015). The initial analysis of the material used key concepts in e-HL as analytical tools – i.e. access, appraise and apply OHI. The researchers read the transcripts separately and used eHL-concepts and the analytical strategies and concepts suggested by Silvermann (24) and Alvesson and Kärreman (Alvesson and Kärreman, 2011) to forward and organise the analysis. The latter suggests that the empirical material is viewed as a "mystery", where the analytical process is facilitated by our hunt for paradoxes or breakdowns. It's by de-fragmentation, defamiliarization, problematization, and application of a broad scholarship and reflexive critique we construct and resolve mysteries – i.e. offer interesting answers to our questions and amend the body of knowledge on the subject of interest (Alvesson and Kärreman, 2011).

If new questions are posed to an existing empirical material, here the question of how KM and eHL relate to seniors use of OHI, Alvesson and Kärreman's (2011) mystery solving approach is a call for an application of a broad scholarship (e.g. KM literature) and reflexive critique.

This paper focuses on the key features of eHL and KM relevant to healthy ageing as presented above: a) individual and socioeconomic factors, b) the different technologies, c) actions taken, d) healthcare context, e) quality of life, and e) lifespan. These features served as an analytical lens for exploring seniors' use of technologies. Therefore, we regrouped and examined a) Knowledge creation and b) Translation and sharing of knowledge c) Applying knowledge. A key challenge for researchers and designers of health technology or online health information, is understanding barriers and drivers for using these resources. The discussion section relates these challenges to definitions of health and KM, and to everyday life as social interaction and participation.

The remaining parts of the paper are organised around eHL as digital practices that relate to accessibility, critical appraisal and application of OHI, and KM as a set of principles, tools and practices that enable people to create knowledge and to share, translate and apply this knowledge.

The quotes below are translated from Norwegian to English by the first author and sanctioned by the second and third authors. All authors are senior researchers.

3. Results

As summarised above, eHL and KM encompasses actions as finding and creating knowledge, accessing, appraising, and applying OHI, using health technologies and digitized services, and eHL and KM implicitly and explicitly put demands on skills, competencies, and socio-materiality (e.g. access to ICT). This section shows how seniors negotiate these demands.

According to Girard and Girard (2015) the four most common verbs in KM-definitions were use, create, share, and manage, and the four most common nouns were knowledge, process, organization, and information. The nouns and verbs capture knowledge creation processes, translation and sharing and applying online health information.

3.1 Knowledge creation – finding online health information

The participants presented themselves from being ignorant to be tech-savvy, depending on the subject matter and the social situation. All participants used computers when they were gainfully employed, e.g. Word Perfect and Excel. All were confident with e-mail, and online services, e.g. online banking, reading news, booking at travel agencies, and social media. All of them owned more than one ICT platform. Even though they were confident in the everyday use of ICT, navigating the Internet for health purposes was a new challenge for them. Later, this will beg questions about how older adults can convert their everyday ICT knowledge to online health behavior and [appreciation of OHI. Keeping up to speed with technology development is harder in retirement, as these quotes illustrate:

> *"I was among the five first teachers at our school to graduate in computing, almost 40 years ago. It doesn't help me much today because we learned to program* (woman, 80)*."*

> *"I used to be a leader and computer teacher and taught others how to punch on those old-fashioned computers. Now I'm a computer student because the development in (ICT) is fabulous. I can't keep up, you know* (man, 66)*."*

They were smiling while talking, acknowledging the speed of technological development and their shift from being tech-savvy to lagging behind. Their basic knowledge about ICT made it easy to ask more skilful (often younger) peers, friends, or family for help. All participants expected that their younger family members were able to keep up with technological development better.

> *"Sometimes I'm able to find it myself, and if not, I ask my daughters or my wife to help me* (man, 74)*."*

They considered e-Literacy to be precarious and to require nurturing e.g. through course work:

> *"I've been to a course, run by SeniorNet, which was very useful. I've actually been an assistant teacher there as well. SeniorNet has a help-line, and they walk you through everything* (woman, 84)*."*

Where available, the participants showed interest in making themselves familiar with electronic health records (EHR). They all knew that the Internet abounded in health information but were not confident in finding and seeing the differences between diamonds and rhinestones. Few, if any, had any knowledge about how search engines rank search results, and none (save for one) had noticed that the presentation of search hits (e.g. titles, URLs, colors) could be used to evaluate trustworthiness or quality of content. All, except for one guided by an instructor from SeniorNet, took the ranking as a kind of quality assurance (the best at the top) and were annoyed when some of the links were adds.

3.2 Translating online health information

All participants launched OHI-searches by entering one or two Norwegian concepts, using the default browser on their preferred device. Searching was motivated by their own concerns or wished to help others, or they were purely curiosities (e.g. regarding celebrities' illnesses):

> *"I search for OHI to help others and to get information* (man, 74)*".*

They also searched to get repeat or confirmatory knowledge:

> *"After I've seen my GP, I go home and search for OHI to assure myself that I understood the information* (woman, 76)*."*

When a medical diagnosis could identify a complaint, this concept was usually used as a search term:

> *"When I searched for OHI about my daughter's diagnosis, I just wrote the diagnosis in the search field. I read whatever turns up* (man, 74)*."*

Others did not use the diagnosis as a search term:

> *"When I search, I describe it, write [about] the symptoms, and then I always get an answer* (woman, 88)*."*

Searching was motivated by finding information that imparted trustworthiness, coherence, and fidelity (Dahlstrom, 2014; Li et al., 2018). They 'favorited' Norwegian hits and pages without ads. Webdesign and domain owner (health services compared to social media) or author, i.e. from whom the content came, were critically appraised. If the page was "nice" and readable, and the information was recognizable, they were more likely to trust it:

> *"I've no idea about how I choose or sort information, maybe I've seen it before, or heard of it*? (man, 70)*."*

Only a few seniors did strategic searches and cross-checked until their queries were settled:

> *"I google and get an extensive list, which I scroll. You do not open all of them, but look for keywords, and then click the ones that look OK. It must be a serious and really [credible] answer to my queries. The best is when it rings a bell about some previous information so that I can judge the content* (woman, 69)*."*

3.3 Sharing and applying online health information

Online health information seeking emerged as a site and case for social participation and interaction (Papen, 2009; Dennis, 2003), which was appreciated, mainly as an opportunity to ponder health concerns :

> *"Well, sometimes I help others, my peers are my age, and we discuss how we do OHI, and share how and where we find what we need. I see one of my colleagues quite often, we talk about everything, and at our age, ailments and diseases flourish. We share our concerns and our OHI findings, and we share information* (man, 66)*."*

Online health behaviour and discussions in social media, or with a physically present person, offer an opportunity to consider whether the reason for searching for OHI should be followed by a GP-visit, or settled by oneself:

> *"I know that OHI may contain wrong and misinformation, so if I'm really worried, I always ask those who are knowledgeable. I can ask our daughter, a nurse, to check my medication. Or I go to my GP; our relationship is very good, he would gladly discuss OHI with me. I don't trust OHI 100%, and if I believe something is really serious, I would always see my GP* (man, 66)*."*

Participants reported that different user-interfaces (phone, tablet, laptop computer, desktop computer, health watch, or TV) demanded different skills and presented different challenges. Age takes its toll, and crooked fingers, dry skin, poor eyesight, and small icons or buttons were annoying barriers:

> *"I have my own PC, but don't use it too much, due to poor eyesight. My tablet is new, and much better for my eyes* (woman, 66)*."*

Age or ability-related barriers were overcome by the changing user-interface, or by collective searches. A striking similarity between the old participants in our study compared to the youngest participants in Diviani et al's study (Diviani et al., 2019), is that OHI is often done in social settings, so search strategies and results can be discussed. The striking differences between these age-groups (comparable to grandchildren and grandparents) is the self-efficacy and confidence the young have in their own ability to find, critically analyse and apply OHI, compared to senior's suspicion of OHI content, lack of trust in themselves, and reluctance to apply whatever they find:

> *"I'm very sceptical of OHI, there's too much information. And how can a lay-person sort this information in an intelligible way?* (woman, 76)*."*

> *"I don't believe this information is doing any good, one gets sicker of it, at the best one is no worse. And not any wiser* (man, 70)*."*

All participants discussed OHI with family and peers and compared hits on "google" with social media. Many of them were laughingly telling about e-mail commercials, alternative medicine, and Facebook ads, adding a solemn comment like "*We are not fooled so easily*". They displayed or wished to show a cool attitude (Zimmermann and Grebe, 2014) towards technology and OHI, often with a twinkle. The coolness personified by these seniors can be compared to calmness and self-control. It takes more than an appealing design or user-interface to convince them to act upon online health information.

4. Discussion

The discussion section relates these challenges to definitions of eHL and KM, and everyday life as social interaction and participation.

A key challenge for researchers and designers of health technology or online health information, is understanding barriers and drivers for using these resources. Senior citizens receive and give help on ICT use and online behaviour, whether this is between family members, friends or communities of interest (e.g. the Senior Net or other communities). As shown above, the seniors are rich in the initiative and determined in their quests for information or in their decision to abstain from trusting OHI. If health is to be understood as collective practice, interaction with general practitioners (GPs), is vital for any health resource. This section shows that seniors are quite strategic in their self-presentation and interaction with their GPs (Goffman, 1959; Goffman, 1969). Seniors are considerate to make sure they are welcomed and treated as credible patients (Werner and Malterud, 2003).

The aim of the study was to explore how a select group of Norwegian seniors accessed, appraised and applied online health information (OHI), individually and collectively, and how they evaluated this information compared to face-to-face health-encounters. Our findings do not provide new knowledge about how socio-economic status, or cognitive or physical capabilities affect OHI behaviour.

Online health information is easily available for everyone. Our participants acknowledge their lacking skills in critical appraisal of OHI's validity and relevance, particularly with their own symptoms or concerns. Discussions with peers and family amend to this, as do their senior coolness (Zimmermann and Grebe, 2014). Health and Internet are social practices for them (Hall et al., 2015; Friemel, 2016; Matthews, Nazroo and Marshall, 2018; Magsamen-Conrad et al., 2019; Nørgaard et al., 2015).

The amount of OHI is soaring and should be used as a resource for supporting and assuring citizens of all ages to engage in digital services for co-/self-manage of own or others' health. Shared decision-making implies mutual learning to reach WHO e-health goals and to reduce the burden of social inequalities in health due to low e-health literacy.

The sage advice from this study can be summed up as a cool pragmatic strategy: OHI is relevant for curiosity, easily self-managed minor concerns, and peer support. When you are really worried, and you should see a GP, not use OHI. Their strategy can be supported by including dialogues on OHI in every health-encounter to promote digital inclusion in later life, particularly inclusion in digital health.

4.1 Challenges and possibilities in design for collective knowledge management

Participants were ambivalent towards sharing their online experiences with their GP and health care personnel, as it might affect the outcome of the consultation negatively. The justification for this standpoint was related to the perceived poor quality of OHI:

> *"I wouldn't dream of telling my GP about my OHI-searches. I'd rather hear the GP's opinion first, and if I'm unsatisfied or disagree, then I might consult OHI and try to sort it out afterward. There is so little time to talk, and I want us to stay focused. That's it! No room for discussing the Internet's answers as well* (woman, 76)*."*

Even though few planned to tell their GP about online searches, some expected it would be well received, while others had tried without much of a response:

> *"I never refer to the Internet, but I think a conversation about it is relevant, and I expect that it would be accepted* (man, 74)*."*

> *"I don't think the GPs are very happy about us reading on the Internet. When I go there and tell him about what I read on the Internet, he doesn't answer too much* (man, 70.)*"*

A well-known barrier is that one can be led astray – towards more or less depressing results and prognosis of an anticipated disease:

> *"I'm born into a cancer family, and I believe that's why I'd rather see my GP and get a clear answer, rather than worrying yourself about possible cancer* (woman, 69)*."*

Participants shared with us a variety of health and ICT competencies, interest, knowledge, and skills in OHI, and shared their considerations about when to offer or ask for help and when to see or not see their GPs. All participants discussed a wide range of health issues with family, friends, peers, and researchers, and were not bothered by lacking skills. This supports an understanding of health and Internet as social practices, for reflection

and learning (Diviani et al., 2019; Hemsley et al., 2018; Huber et al., 2011; Magsamen-Conrad et al., 2019; Nørgaard et al., 2015; Silver, 2015) – at least outside the realm of the health care sector. Citizens' self-presentation, negotiations and considerations in everyday social interaction emerge as issues designers of ICT and OHI should consider.

5. In conclusion

The aim of the present paper is to present and discuss health KM from senior users of online health information (OHI) point of view. We have explored how they accessed, appraised, and applied OHI individually and collaboratively, and how they evaluated this information compared to face-to-face health-encounters. The paper exemplifies needs to be considered by health care providers for more suitable support for aged citizens. By examining differences in competency in KM for health and the use of OHI acquisition and support needed, the results pinpoint how providers must assure aged citizens that OHI and collective management are assets for healthy aging and managing health concerns.

Our participants acknowledged their lack of trust and/or skills in critical appraisal of the validity and relevance of OHI, particularly about potentially serious health concerns. As shown above, the social settings around internet searches paved the way for discussions with peers and family, which partly compensated for a lack of skills or affirmed their lack of trust in the findings. The coolness they displayed, i.e. being calm and critical towards the content, also made them prioritise seeing their GP when there were any pressing issues or concerns (Zimmermann and Grebe, 2014). Health and Internet are social practices for them (Papen, 2009; Hall et al., 2015; Nørgaard et al., 2015; Friemel, 2016; Matthews, Nazroo and Marshall, 2018; Magsamen-Conrad et al., 2019). This study acknowledges the usefulness of e.g. Wang's suggestion for combining individual and collective access (Wang et al., 2008) to online media to achieve higher trustfulness in the retrieved data.

The seniors in this study used digital technologies daily to access news media, Internet banks, e-mails or travel agencies. They are skilled and active knowledge producers, shares and users. They shifted roles between guiding peers on the Internet and being supervised by peers or younger next of kin – they literally enacted health as a social practice. Interestingly, none of the definitions of eHL presented in section 1, include theoretical discussion or definitions of health. The WHO (1948) definition of health builds on a medically informed approach to the body, which is quite different from Crawford's (2006) understanding of health as a meaningful social practice and Huber'et al.s' (2011) understanding of health as an amalgam of resources (including the body). This might put new definitions of eHL at risk of being less useful and outdated because they do not capture contemporary framings of health as a bodily and social phenomenon. A theoretical discussion of health is necessary when we inquire into the health-related use of digital technologies and the Internet, to understand why and how citizens approach digital health technology at large. Neither of the definitions of eHL discusses citizens' participation in defining or measuring eHL, or their opinions on the usefulness of OHI in everyday living, quality of life, or in shared decision-making in health-encounters. Lastly, but no less, neither of the framings of eHL acknowledge the complexity of social interaction, ICT use and OHI, and healthy ageing.

The amount of OHI is soaring and should be used as a resource for supporting and assuring citizens of all ages to engage in digital services for co-/self-management of one's own or others' health. Shared decision-making implies KM and mutual learning to reach WHO e-health goals and to reduce the burden of social inequalities in health due to low e-health literacy. E-health literacy is a social determinant for health, and healthy ageing presupposes e-health literacy – broadly defined. KM – from acquisition to use – is a social practice where the relevance of ICT, OHI or knowledge is negotiated in a situated context. Our findings do not provide new knowledge about how socio-economic status or cognitive or physical capabilities affect OHI behaviour. Further studies need to look into this.

Handling eHealth is slowly becoming an integral part of our life, and eHL influences the quality of life (Bautista, 2015; World Health Organization, 2005; World Health Organization, 2016; World Health Organization, 2020). This study illustrated the differences between skills for handling ICT and strategies for interpreting and assessing trustworthiness of OHI for a group of seniors in Norway. However, further research is needed not primarily for improving user experiences, but on how end-users can be engaged as active participants in design of ICT and OHI throughout their lifespan, to enhance the value of ICT and OHI as assets for healthy ageing, quality of life and social participation.

The current advice from this study can be summed up as a cool pragmatic strategy: OHI is relevant for curiosity, for easily self-managed minor concerns, and for peer support. However, when really worried, the seniors in this study preferred to see their GP and did not trust OHI. Their strategy can be supported by including dialogues on OHI in every health encounter to promote digital inclusion in later life, particularly inclusion in digital health. KM related to health is a social practice, and the contingency of ICT or OHI must be addressed.

- E-Health literacy encompasses individual and peer-based knowledge, skills and competencies that are obtained and utilised beyond health care settings.
- Older adults make health-relevant decisions in a wide range of contexts outside the health care sector – individually and collectively.
- Health care personnel must acknowledge older adults' online health behaviour, and include their knowledge, skills, and competencies in the dialogues in the consultation room.
- Responses towards emerging aged digital health divides must include alternatives to self-management and digitization and acknowledge older adults as active social learners in digitized or analogue environments.

A first possible step after this study is to examine if the opinions of other older adults in Norway, and maybe as the next step in Scandinavia or other countries are the same concerning their acceptance of health technologies that become a part of their lives. The information may contribute to developing a more adequate methodology to collect data from many. This study begs for an international comparison of how older adults navigate in digitized societies, and if and how digital divides are approached, negotiated and lived.

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Literature review on Health Knowledge Management in the last 10 years (2009-2019)

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Abstract: Health care institutions (HCI in further text) are in constant interplay with their context, generating ensuing opportunities and threats. Knowledge management has been paramount when it comes to integrating state-of-art technologies in order to improve system efficiency and decision processes in hospital management outputs. Thus, it is pivotal to explain the role of knowledge management in hospital management. Research of peer-reviewed articles published from 2009 to 2019, and obtained via the Scopus database, was carried out based on two key subjects, 'knowledge management' and 'health care institutions'. The research was performed through a descriptive, quantitative and qualitative analysis of the most cited 47 scientific articles found in the SCOPUS database. We conclude that 'knowledge management' (KM in further text) has become an important research area in terms of HCI management. The article identifies the central themes in KM research in HCI. However, the area on KM literature is highly fragmented, requiring development. Based on an analysis of the collected literature, we identified the key research themes and resulting development patterns, namely, the integration and interoperability of knowledge from different sources into a single platform, occupational safety, the need to ascertain quality and pertinent information among general web information, culture and social behaviour and data security. We posit that KM effectively facilitates the utilization of healthcare information resources and management decision making in hospitals.

Keywords: knowledge management, health care institutions

1. Introduction

Knowledge management in health care institutions has emerged as an important stream of research at the interface of technological innovations and health systems. If we consider knowledge management as a set of technologies and processes whose objective is to support the creation, transfer and application of knowledge in organizations (Girard and Girard, 2015), we would enhance the link between KM and the idiosyncrasies of HCI. Our research goal is focused on examining the interplay between those two branches of knowledge on literature, and the ensuing findings aim at expanding the literature on the relationship between KM and HCI by highlighting the main trends and themes.

Although KM in HCI research has gained momentum lately while providing insights into knowledge sharing in health communities, it is important to reinforce results from related research in health and knowledge management, relevant to both health informatics literature and health community management (e.g., Yan et al., 2016; Tuarob et al., 2013; Mafabi et al., 2017; Chandra and Loosemore, 2011; Gu et al., 2019). The literature in the topic is diverse and fragmented, hindering the development of the subject as a promising research area. In this paper, an analysis of the 'KM in HCI' literature is performed based on citations of 47 central articles in order to examine the development and identify research themes and developmental patterns of 'KM in HCI' research (e.g., Yan et al., 2016; Tuarob et al., 2013; Mafabi et al., 2017; Chandra and Loosemore, 2011; Gu et al., 2019).

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This paper addresses the sparse literature on those topics, and related intersections between the KM and HCI best practices regarding some central themes that emerged from a Scopus database literature survey. Hence, the focus of this literature review (LR in further text) is on 'KM in HCI' most cited issues.

Based on the literature review, this article aims to clarify the knowledge management in Health in the last 10 years and the main contributions and implications, specifically, to know to what extent issues related to knowledge sharing, information dissemination and artificial intelligence, identifying paths and themes for the future focusing on the following aspects: Integration and interoperability of knowledge; which deal with facilitating communication, cooperation, and collaboration within an organization (verdanat, 2009); Artificial Intelligence (AI) in knowledge management systems: AI can extend socially-based conceptual KM tools through supporting human agents manage most forms of knowledge (Sangozi, Guzman and Busch, 2017), interaction of KM with AI makes possible the development of filtering tools and pre-analysis of the information that appear as a reply to the expectations to extract resulted optimized of databases and open and not-structuralized source, as the Internet (Hoeschl and Barcellos, 2006); and Ubiquitous Technologies: smart organizations do not rely on knowledge production, but focus on knowledge integration instead (Kaivo-Oja et al, 2015).

The document is divided into three parts. The first presents the research methodology illustrating the various steps followed in database segmentation, as well as a review of the literature on health knowledge management in the last 10 years (2009-2019). The second part presents the results with a long list of considerations and findings from the articles investigated and finally a third part integrates a discussion and conclusions from the research.

2. Methodology

Knowledge production requires deep understanding and domain of the concepts related to the subject to be researched. Comprehensive literature review is a *sine qua none* condition to better understand how the problem has been investigated and dealt with. Literature review helps defining the problem and aids in the search for new investigation techniques, by identifying methodologies that have not yet been tested.

Having as subject the analysis of different marketing strategies for product development, a compilation of peer-reviewed literature took place. Employing this method allows for a broad collection of the different product development strategies, as well as it promotes a good understanding of how these have evolved throughout time, while identifying the researchers, peer-reviewed literature and the subject of the most relevant peer-reviewed articles (Rosário and Cruz, 2019; Sacavém, et al., 2019; Rosário, 2018; Willett, 2007 Granovsky, 2001). The revision and compilation of peer-reviewed literature allows summarising the main questions and results obtained in these studies, whereby these can have conceptual or empiric character. The main limitation of our methodology lies on the fact that the gathering of information is carried out through slow and extensive manual work. Modern internet services and databases allow easy and fast access to documents in electronic format, helping the dissemination of peer-reviewed literature.

In this context, the revision of peer-reviewed literature consists on the 1) identification, 2) selection, 3) analysis, and, 4) summarization of the existent knowledge about a specific theme, as per the method employed by Denyer and Tranfield (2009).

Making use of the above-mentioned method, we will 1) define the research purpose, 2) select the databases from which the information will be compiled from, 3) evaluate and select peer-reviewed literature, 4) analyse and summarise the findings, 5) present the results, and, 6) discussion and conclusion of the results obtained, this methodology will ensure that a broad reach, that is equally auditable and repeatable, while answering specific questions arising from this research (Rosário and Cruz, 2019; Sacavém, et al., 2019; Rosário, 2018). During March 2020, a survey and literature review on Health Knowledge Management in the last 10 years was carried out.

The survey was conducted in the Scopus database which according to Elsivier is the largest abstract and citation database of peer-reviewed literature: scientific journals, books and conference proceedings.

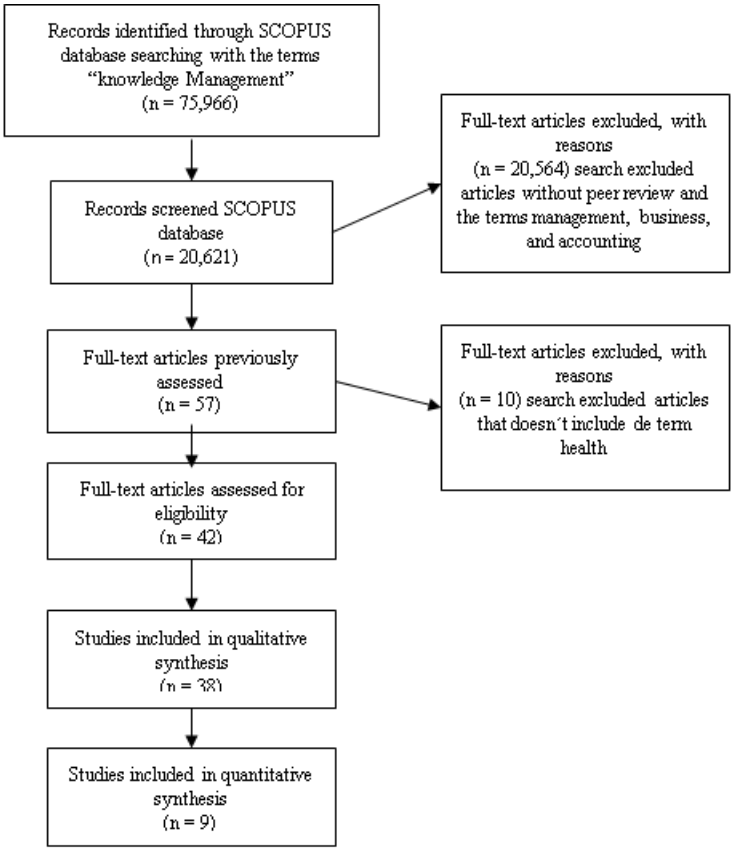

Figure 1: Segmentation criteria – adaptation from the PRISMA model (Mother et al, 2009)

For research purposes the topic "knowledge management" was initially used, obtaining 75,966 documents. Having then limited the search to the topics of business, management and accounting, several articles were eliminated and this segmentation retained a total of 20,621 documents. Finally, by restricting the latter to a new segmentation by delimiting it to the keyword "Health", a result of 57 documents was achieved. The final criteria to which these last articles were exposed included the peer review criteria for the time period between 2009 and 2019.

The final number of articles obtained is 42, which constitutes the universe on which this research was focused. Figure 1, above placed constitutes an adaptation of the PRISMA model (Mother et al, 2009) and tries to illustrate the procedure described.

The found peer-reviewed literature makes use of different methods, with most of them being case studies and some quantitative research. When examining the methods and associated type of analysis, we found that 5 out of 47 articles focus on “individuals” or “communities” (Margerite, 2018; Tate et al., 2011; Gonçalves, Silveira and Rocha, 2011; Bratu, 2010; Yan et al., 2016; Warkulwiz, Paul and Mehta, 2014).

The remaining 42 articles focus on analysis at the organizational level. There is a clear emphasis on qualitative case study analysis (38 articles) as opposed to quantitative analysis (9 articles - Gu et al., 2019; Jimmy et al. 2019; Allerhand et al., 2018; Lagrosen, 2018; Yan et al., 2016; Sun, Huang and Chu, 2015; Koeling, Tate and Carroll, 2011; Emerencia et al., 2011 Farouk, Richardson and Santhapparaj, 2011).

3. Results

The most productive year for peer-reviewed articles on KM and HCI, was 2011 with 18 publications (2019, 3; 2018, 5; 2017, 2; 2016, 1; 2015, 3; 2014, 1; 2013, 1; 2012, 3; 2011, 18); 2010, 8; 2009, 2). Graph 1, we can analyze the evolution of publications over the years. The articles were published as follows: 30 in conference papers, 15 articles and 2 reviews.

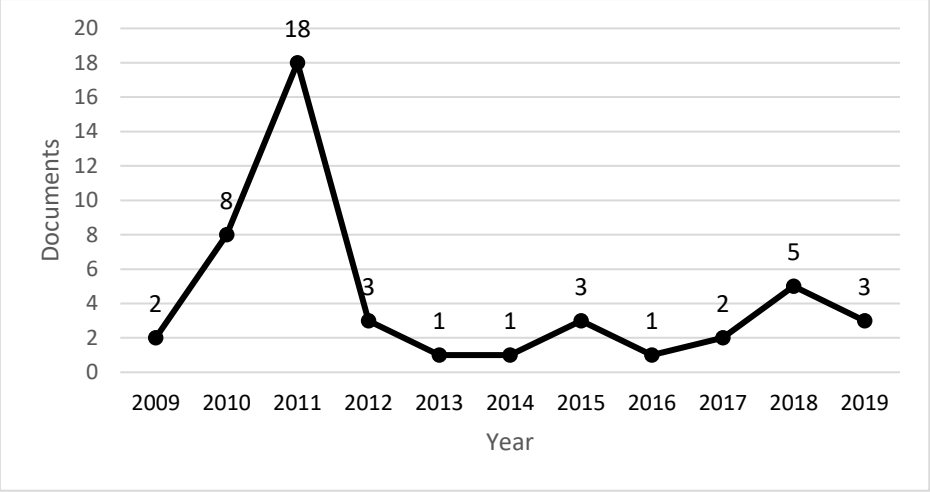

Figure 2: Documents by year

Table 1 summarises the Scimago Journal and Country Rank (SJR) impact factor, for the sources of publication of the collected peer-reviewed articles. SJR, Best Quartile and the H index per publication, are provided for each of the publication sources. Information and Management is the most quoted source, with 1,727 (SJR), a Q1 Best Quartile and an H index of 142. Worth mentioning are are 4 newspapers from Q1 and 6 newspapers from Q2, 2 newspapers from Q3, 2 newspapers from Q4.

The International Conferences on Information and Knowledge Management Proceedings and Proceedings of The International Conference on Intellectual Capital Knowledge Management and Organisational Learning Icickm, have an SJR score of 0.519 and of 0.111 respectively. Conferences represent 33% of the publications.

Table 1: Scimago journal and country rank impact factor

Title	SJR	Best Quartile	H index
International Conference on Information and Knowledge Management Proceedings	0,519	- *	102
Business Transformation Through Innovation and Knowledge Management An Academic Perspective Proceedings Of The 14th International Business Information Management Association Conference Ibima 2010	0	- *	3
Information and Management	1,727	Q1	142
Proceedings of The International Conference on Intellectual Capital Knowledge Management and Organisational Learning Icickm	0,111	- *	3
Vine Journal of Information and Knowledge Management Systems	0,362	Q2	24
ACM Transactions on Information Systems	0,550	Q1	75
British Food Journal	0,485	Q2	69
Business Information Review	0,231	Q2	14
Communication et Management	0,480	Q2	31
Construction Management and Economics	0,777	Q1	81
Development and Learning in Organisations	0,138	Q4	13
Engineering Construction and Architectural Management	0,580	Q1	49
Innovation and Knowledge Management A Global Competitive Advantage Proceedings of the 16th International Business Information Management Association Conference Ibima 2011	- *	- *	2
International Conference on Management and Service Science Mass 2011	- *	- *	5
International Journal of Grid and Utility Computing	0,462	Q2	14
International Journal of Information Systems and Change Management	0,130	Q4	10
International Journal of Innovation Science	0,185	Q2	9
International Journal of Knowledge Management	0,307	Q3	19
International Journal of Technology Management	0,502	Q1	51
Lecture Notes in Business Information Processing	0,243	Q3	40
Proceedings 3rd International Conference on Information Management Innovation Management and Industrial Engineering Iciii 2010	- *	- *	8
Proceedings of Institution of Civil Engineers Management Procurement and Law	0,160	Q3	8
Proceedings of the 4th IEEE Global Humanitarian Technology Conference Ghtc 2014	- *	- *	10

Title	SJR	Best Quartile	H index
Proceedings of the 6th Iberian Conference on Information Systems And Technologies Cisti 2011	- *	- *	8

Note: *data not available.

The subject areas covered by the 22 scientific articles were: Business, Management and Accounting (47); Decision Sciences (29); Computer Science (12); Engineering (8); Social Sciences (4); Mathematics (2); Agricultural and Biological Sciences; Economics, Econometrics and Finance (1).

The most cited article was the "Inter-organizational knowledge sharing system in the health sector: Physicians' perspective" by Al-Busaidi (2015), with 96 citations published in the International Journal of Knowledge Management, scoring 0.307 on SJR, with a Best Quartile Q3 and with an h-index 19, (2016, 2; 2017, 12; 2018, 26; 2019; 49 2020, 7).

Articles published in the International Journal of Knowledge Management newspaper focus on the study of the attitude of doctors towards the implementation of the interorganizational knowledge sharing system in the health sector. The case study was conducted in Oman.

Figure 2 shows the evolution of citations for articles published between 2009 and 2019. The number of citations dropped between 2013 and 2016, reaching a record of 73 citations in 2019.

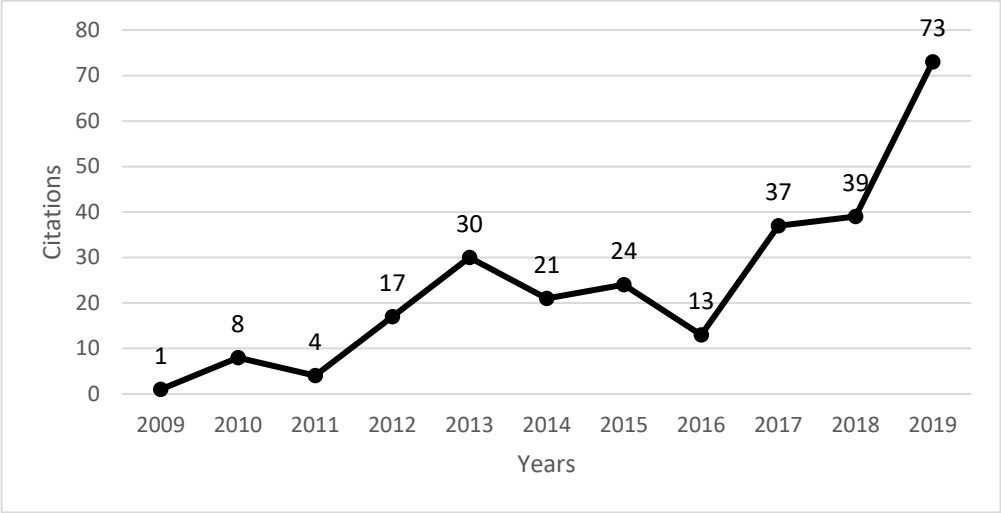

Figure 3: Evolution of citations between 2009 and 2019

The h-index was used to purchase the productivity and impact of the published work, based on the largest number of articles included that had at least the same number of citations. Of the documents considered for the h-index 8, have been cited at least 8 times (Figure 3).

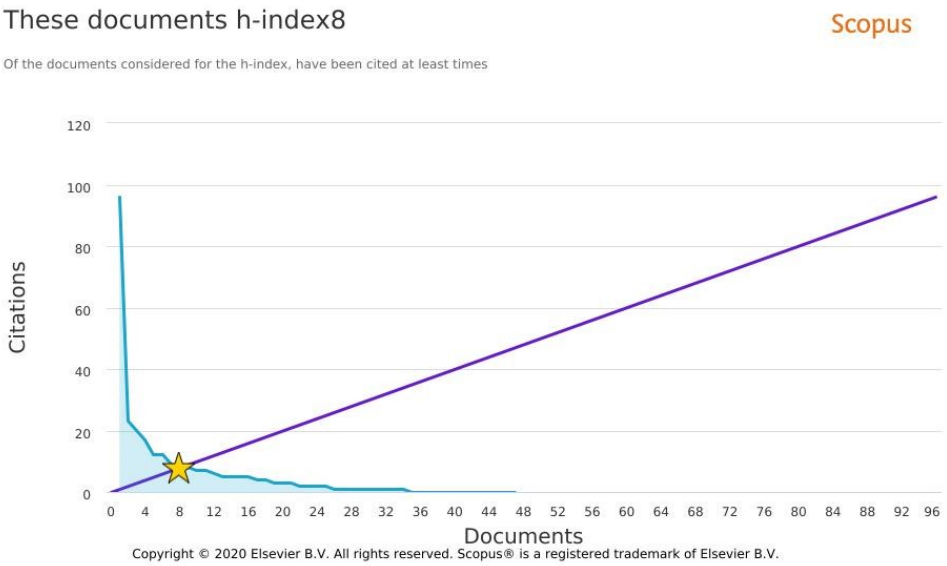

Figure 4: Documents h-index 8

Source: Scopus.

Appendix I analyzes the citations of all scientific articles from 2009 to 2019. 15 documents were not cited between 2009 - 2019 and in 2009, 1; 2010, 8; 2011, 4; 2012, 17; 2013, 30; 2014, 21; 2015, 24; 2016, 13; 2017, 37; 2018, 39; 2019, 73, a total of 267 times, 1 open Access and 46 with different types of access, divided as follows: Conference Paper (30); Article (15); Review (2) by subject area: Business, Management and Accounting (47); Decision Sciences (29); Computer Science (12); Engineering (8); Social Sciences (4); Mathematics (2); Agricultural and Biological Sciences (1); Economics, and Econometrics and Finance (1).Conference Paper 30, by subject área: Business, Management and Accounting (30); Decision Sciences (26); Computer Science (4); Engineering (3) and Mathematics (1).

Article 15, by subject area: Business, Management and Accounting (15); Computer Science (8); Engineering (5); Decision Sciences (3); Social Sciences (3); Agricultural and Biological Sciences (1) and Mathematics (1). Por último, Review 2, by subject área: Business, Management and Accounting (2); Economics, Econometrics and Finance (1); Social Sciences (1).

In Annex II, we analyzed the self-citation of documents during the period from 2010 to 2019, 9 documents were self-cited 20 times, the Service and dynamic integration oriented to health data models (2011), an article presented at the International Conference on Information and Knowledge Management, Proceedings was self-cited 4 times in 2913, 1 time in 2014, for a total of 5 in the period 2009-2019. The document Knowledge sharing in online health communities: a perspective on the social exchange theory of Yan et al. (2016) was the least self-cited 1 times in 2018.

Of the 47 scientific articles, 15 were never cited (Table 2), 4 of the non-cited articles were published in the Business Transformation Through Innovation and Knowledge Management an Academic Perspective Proceedings of The 14th International Business Information Management Association Conference Ibima 2010, the article Impacts of case-based health knowledge system in hospital management: The mediating role of group effectiveness published in Information and Management, the SJR 1,727, Best Quartile Q1 and H index 142 of 2019 was not mentioned during the period.

Table 2: Documents without citations during the period of 2009 and 2019

Documents	Investigator	Title	SJR	Best Quartile	H index
Impacts of case-based health knowledge system in hospital ma ...	Gu et al. (2019)	Information and Management	1,727	Q1	142

Documents	Investigator	Title	SJR	Best Quartile	H index
Health card retrieval for consumer, health search an empírica ...	Jimmy et al. (2019)	International Conference on Information and Knowledge Management, Proceedings	0,519	- *	102
Briefing: Status of occupational safety and health in GCC co ...	Umar et al. (2019)	Proceedings of Institution of Civil Engineers Management Procurement and Law	0,160	Q3	8
Place du knowledge management dans les organisations de sant...	Margueritte (2018)	Communication Et Management	0,480	Q2	31
The effects of workplace learning on employee health	Lagrosen and Lagrosen (2018)	Proceedings of The International Conference on Intellectual Capital Knowledge Management and Organisational Learning Icickm	0,111	- *	3
A fuzzy association rule-based knowledge management system f...	Tsang et al. (2018)	VINE Journal of Information and Knowledge Management Systems	0,362	Q2	24
Developing a knowledge strategy for medical humanitarian cri ...	Stoddart et al. (2015)	Proceedings of The International Conference on Intellectual Capital Knowledge Management and Organisational Learning Icickm	0,111	- *	3
Paying the price as firms edge out talent: Knowledge can be ...	(2012)	Development and Learning in Organisations	0,138	Q4	13
Developing quality scores for electronic health records for ...	Tate et al. (2011)	International Conference on Information and Knowledge Management, Proceedings	0,519	- *	102
Occupational safety and health committees: A channel for knowledge creation in malaysia?	Farouk, Richardson and Santhapparaj (2011)	Innovation and Knowledge Management A Global Competitive Advantage Proceedings of the 16th International Business Information Management Association Conference Ibima 2011	- *	- *	2
Research on the operation mechanism of EHMS	Xia, Zhao and Qi (2010)	Proceedings 3rd International Conference on Information Management Innovation Management and Industrial Engineering Iciii 2010	- *	- *	8
Assessing the quantitative factors ofhealthcare services	Cicea e tal. (2010)	Business Transformation Through Innovation and Knowledge Management an Academic Perspective Proceedings Of The 14th International Business Information Management Association Conference Ibima 2010	0	- *	3
Evaluative indicators ofthe health ofthe organisations of ...	Mureşan and Ivan (2010)				
Insight into tunisian consumers' mind-set towards healthines ...	Lakhdar and Bouslama (2010)				
Health politics and systems in the European Union: Partícula ...	Bratu (2010)				

Note: *Data not available

The analysis is based on the total of 47 most cited articles, out of a Scopus search centred on the keywords 'KM' and 'HCI'. The analysis follows the mentioned thematic, focusing on the main themes and trends of literature. This leads to the identification of the key topics on the subject, discussed below.

The most recurrent theme in literature of KM in HCI is the integration and interoperability of knowledge from different sources into a single platform to ease its understanding by physicians. The goal is to achieve common understandings and semantics.

First, some research focused on methods to rank health cards, a domain-specific type of entity cards, for consumer health search (CHS) queries as small evidence exists to verify the electiveness of ranking methods for health cards in CHS (Jimmy et al. 2019). Others improve the delivery of the right information about the right

patient at the point of care in order to attain a well-integrated and interoperable healthcare process, which is not easy to achieve due to the various differences in health data that cause enormous interoperability challenge (Taweel et al. 2011). Artificial Intelligence has been a challenge as well as case-based health knowledge management systems (CBHKS) have been extensively adopted in hospitals, including data-driven intelligent platforms that integrate 'state of the art' decision processes to improve hospital management outcomes (Gu et al. 2019).

Second, on the one hand, the need to unify distinct information for epidemiological research, as for example the General Practice Research Database (GPRD) with distinct coded information and an automatic method to extract significant information (Koeling, Tate, and Carroll, 2011), or on the other hand a framework for further improvement of existing methods of data quality assessment, using statistical pattern recognition techniques (Tate et al., 2011).

Third, some studies present systems such as a Semantic Web interoperability framework, which provides developers with software for semantic application deployment that allows interoperability (Lopes and Oliveira, 2011; Lytras, Sakkopoulos and De Pablos, 2009); while others focus on the need for semantic integration of different understandings through thematic content analysis (for example between designers and hospital constructors), to ensure optimal health outcomes by exploring the process of knowledge sharing during the project (Chandra and Loosemore, 2011) and also ensure efficiency, effectiveness and adaptability in HCI (Muresan and Ivan, 2010).

Fourth, research enhances the use of Information and Communication Technology (ICT) as a medium to integrate different information in different clinical points (Bouamrane and Mair, 2011), to build-up both the integrated equipment health management information system, structure and design (Zhang, Yu and Mu 2011) and the integration of the equipment health management system (e.g., between management theory and equipment health management) (Xia, Zhao and Qi, 2010).

Fifth, there is a research call for using compatible data formats and international terminology to ensure both the Interoperability between complex systems knowledge (Emerencia et al., 2011), data applications in healthcare (Tao et al., 2011) and the vast bio-medical knowledge to ensure an integrated electronic health systems infrastructure (Bouamrane and Tao, 2011). It has also been central to timely integrate disparate public health information systems from diverse geographic regions to better address emerging public health threats (e.g., the US Centers for Disease Control explored a decentralised information architecture using the Public Health Grid) (Boyd et al., 2011).

Finally, besides semantic and equipment integration, also the service integration is debated in literature. An ontology-driven framework was attempted to provide knowledge management for data of different modalities (e.g., by remote services in supporting multidisciplinary meetings that take place during breast cancer) (Dupplaw, et al., 2009). Furthermore, it is frequent to discuss the interoperability and integration of knowledge issue in less favoured contexts. In particular, in terms of insurance system with respect to coherent operation of social health insurance systems that support economic systems (Bratu, 2010); the focused crawling technique in the area of Information retrieval in specific search engines for health in non-representative languages (Pryiatam, 2012); and the need to share knowledge effectively with Community Health Workers (CHWs) within less favoured communities of low technological level (Warkulwiz, Paul and Mehta., 2014).

Other recurrent issue is occupational safety. It has been centred on warehousing operations to create a comfortable and safe workplace environment in terms of minimizing accidents by health and safety programs (Tsang et al., 2018). Other studies focus on the associations between workplace learning / organizational climate and the health of the employees, in particular by investigating sexual harassment and workplace bullying, concluding that knowledge learning has implications on improved health (Lagrosen, 2018). Also, it was presented the implications of design choices in infographics for construction for workers' health and safety, concluding that such infographics enabled the workers to make a more global assessment of the health and safety implications (Lingard et al., 2018).

Finally, comparative studies between developing and developed regions in terms of safety performance regarding the awareness and importance of safety, cost of accidents, environmental and climatic factors which

affect the workers, occupational safety and health regulations and their implementation, workers' well-being, safety culture and safety climate (Umar et al., 2019) have been carried out.

Another recurring research subject is the need to ascertain quality and pertinent information among general web information. The focus is on the absorption and dissemination of relevant knowledge to physicians. One suggested solution consisted of a system of interest-aware topic model (IATM), in which known higher-level interests on topics expressed by each user can be modelled in consumer health forums of user's self-reported medical conditions / topics. Then, additional techniques capture how users cope with the various symptoms belonging to the same clinical condition allowing in this way the use of recommendations for given health conditions (Halder, Kan and Sugiyama, 2017).

Social media has emerged as an influential tool in terms of sharing relevant information and ensuing dissemination. Peer-reviewed literature has proposed epidemic surveillance systems that employ social media to detect the emergence of diseases. It has unveiled the flaws of traditional document classification techniques and proposed features that represent different semantic aspects of the data, in combination with ensemble machine learning techniques to identify health-related messages amid social media data. The results disclose significant improvement in identifying health related social media content, critical in the advent of a novel disease epidemic (Tuarob et al., 2013).

The selection of important information has been central to feed health delivery systems with subsequent huge impacts on patients' care outcomes. The electronic health information management systems need to guarantee the integrity of clinical data capture and the quality of information processing. Some research has debated how issues of poor data quality and information mismanagement, impact on the clinical meeting and propose a complete description of data quality issues in eHealth (Bouamran, Mair and Tao, 2012).

The concern with electronic selection of key information has been extended to the Internet. As the Internet has become one of the main sources of consumer health information, e.g., through YouTube, it is worthy to find appropriate health videos while avoiding misleading information (e.g., herbal cures for diabetes or cancer). Some research developed algorithms for ranking the most important internet channels based on professional reviewers (Fernandez-Luque, Karlsen and Melton, 2011). This main concern has been extended as well to mobile devices as tools of information sharing. The response was based on the concept of Augmented Reality intended to make systems more usable by decreasing the need of cognitive load inherent to their use. (Magalhães, Castro and Carvalho, 2011).

Culture and social behaviour is a frequent research topic, exploring either representations, or common attitudes. The subject of ontology is largely represented on this domain. Some literature enhances the need of knowledge sharing behaviour, analysing the relationship between attitude, subjective norm, perceived behavioural control and knowledge sharing behaviour. It concluded for a positive and significant relationship between those variables in HCI (Mafabi et al., 2017). In the same vein, a positive relation between organizational culture and knowledge management in HCI has been evidenced due to the need for preservation and distribution of knowledge among collaborative individuals, being therefore essential to know the role of the actors allowing creating a common knowledge frame (Margerite, 2018).

This common understanding is often achieved by online health communities (OHC) that become valuable platforms for patients to communicate and find support. Some research shows how OHC members share general and specific knowledge demonstrating that although personal benefits promote knowledge sharing and costs prohibit it, three factors positively impact the sharing of both general and specific knowledge: a sense of self-worth, members perceived social support, and reputation enhancement (Yan et al., 2016). Others, in turn, have focused on the physicians' attitude towards inter-organizational knowledge sharing system (IOKSS) deployment in the health sector, indicating that peers, the sector and knowledge workers, are critical factors to physicians' attitudes toward IOKSS, whereas physicians' attitudes are positively associated with their intention to share knowledge (Al-Busaidi, 2015).

In terms of Internet gathered information, it has been evidenced that the consumer's ethical evaluation impacts the business by evaluating the nutrition label through websites. There is a moderating effect of nutrition knowledge, in terms of both subjective and objective nutrition label knowledge, between health consciousness and nutrition label attitude (Sun, Huang and Chu, 2015). Conversely, other research examines delivering health

information to the end-users via coherent conversations, instead of sharing information by the Internet. The conversational system allows the end-users to express and refine their information needs using only natural language questions or statements as input, avoiding therefore the inadequacies of current delivery mechanisms (Wong, Thangarajah and Padgham, 2011).

Other studies focus on the cultural barriers that hinder the cooperation amongst agencies that constitutes often a critical problem in crisis management. For example, the Medicins Sans Frontières (MSF) an independent, medical humanitarian organization that has been acclaimed for its efforts to respond to epidemic crisis, has been pushed to the limits in terms of knowledge and information requirements, which required reviewing is organizational culture to explore how the sharing of knowledge can be exchanged (e.g., little information or knowledge shared between countries) (Stoddart et al., 2015).

It has been substantial efforts to find out common culture. The quality of life and the condition of health cannot be analysed without taking into account the cultural conditions (Cicea , 2010). Thus, some studies have focused on the perception that an individual holds on his place in life, which depends on his culture and defines the individual's health-related quality of life. This is a medical goal to be obtained through software platforms, allowing therefore the physicians to analyse it (Gonçalves, Silveira and Rocha, 2011). Conversely, others recur to ontologies to implement electronic health records (EHRs), robust in terms of their content and intuitive in terms of their value, since ontological approaches reflect the usual ways in which people cope with the world, allowing thus to model information (Little, 2010).

Data security in terms of clinical information is deemed also as a common topic. The concerns range from timely responses to pandemics to the protection of clinical data. The present pandemic at the moment of writing is showing the astonishing pace at which infectious diseases can spread globally, and officials must be prepared to react faster and with greater intelligence gathering capabilities. However, and as shown, state-of-the-art systems for Epidemic Intelligence have not kept the pace with the growing need for more robust public health event detection. In the face of this, some propose approaches that combine aspects from different feature-based event detection methods (Fisichela et al., 2010), while others underscore the need of continuous monitoring through automated control and quality management systems (Hulstiin et al., 2011).

In addition, the ISO 9001:2000 norm can embrace these concerns, supervising the quality of a Knowledge Creation Model for occupational safety and health committees (OSHCs) and its subsequent transformation into quality information (Farouk, Richardson and Santhapparaj, 2011). Finally, other research focuses on security and protection of sensitive medical data such as Electronic Health Records (EHR) by presenting an overview of security threats in pervasive healthcare and presents a secure communication scheme that outperforms the existing schemes by decreasing transmission and storage cost (Acharya and Kumar, 2010).

Last but not least, it is worth mentioning the issue of information retrieval (e.g., during reorganization processes). Besides knowledge assimilation and dissemination, the storage of relevant knowledge is also an important issue. In this way, some highlight the importance of knowledge management during organisational reorganization and describe the approach to enable HCI business continuity by embedding knowledge management into informatics projects. So that corporate knowledge became retained in the system and shared with successor organizations (Leyton and Lambe, 2011).

4. Discussion and conclusion

In the last decade, papers on the KM and HCI topics have been published uninterruptedly on a yearly basis. 2011 shows the largest number of published works with a count of 18, followed by 8 in 2010, and 5 in 2018. The other journals or publication vehicles display anywhere between 1 to 3 articles per year. These results show that studies on KM have increased lately (growth percentage year on year since 2009 is 64%, and on overall is of 9%) in an effort to understand how HCI work with knowledge to develop new integrative platforms, new security processes, new shared culture and new forms of ascertain relevant health information with a view to ease interpretation in care points.

KM should therefore progressively be part of HCI strategies and of the knowledge-based economy as well, along with the rising evaluation of relevant and opportune knowledge, which may have influenced research on the KM in the last ten years in the health sector. lastly, health workers may be discovering the importance of KM in

the HCI as their activities always involve human relations and communication. in addition to this, the implementation of KM involves sustainable core advantages that are organization-specific.

KM's contributions in health resulted in four major theme categories. The first refers to the development of KM systems in the integration and interoperability of knowledge from different sources into a single semantic platform (20 studies). It points to the need to use theoretical models and programs/software to assess KM at HCI.

Culture and social behaviour is also cited as a recurrent theme (10 articles) in terms of knowledge sharing solution that permits exploring all available knowledge in the organization for the sharing of relevant data and their dissemination, respond to epidemics and ethically acquaint health information. In other words, it refers to the interplay between explicit and tacit knowledge.

The necessity to ascertain quality and pertinent information among general web information is represented in 6 studies, in which is appointed barriers to information collection, such as the inadequacy of equipment and flaws in messages and web services.

The need to develop information technology solutions, using KM to provide occupational safety is represented in 5 studies, in terms of protection of medical data, address gaps and detect epidemics timely.

Finally, the use of KM as a resource to secure data (4 articles) has been explored in terms of epidemics intelligence, monitoring and quality control, in order to better support decision making in health and support systems. Through organizational change it was explored how the knowledge was secured and stored for change and how the system's architecture was developed (one article).

Due to this LR, the decision-management processes, communication system and enculturation should cooperate towards the implementation of KM, which therefore strengthens trust in the use of these tools for decision making, within communities. The studies analysed reinforce in this way the importance of seeking scientific studies to support health practices, as well as using and transforming information into practices that can be socialized to health professionals. This process aims to make knowledge accessible to all as economic globalization, driven by information and communication technologies turns KM a strategic resource to HCI.

The overall research carried out confirms as important issues those identified above that relate to Knowledge Integration and Interoperability (3 articles); AI in Knowledge Management Systems (2 articles) and Ubiquitous Technologies (3 articles).

This investigation despite using one of the most relevant databases of the academic environment, might however be considered a weakness. As a suggestion for future developments it is suggested to expand the databases to be used, namely by using research from WoS academic journals.

Finally, the four thematic categories presented lack research on KM in health in order to clarify and consolidate knowledge in the area.

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Annex I: Overview of document citations period 2009 to 2019

Documents		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Detecting Parkinson's disease from interactions with a searc ...	2018	-	-	-	-	-	-	-	-	-	-	1	1
Making the invisible visible Stimulating work health and saf...	2018	-	-	-	-	-	-	-	-	-	-	2	2
Health forum thread recommendation using an interest aware t ...	2017	-	-	-	-	-	-	-	-	-	1	-	1
The mediation role ofintention in knowledge sharing behavio ...	2017	-	-	-	-	-	-	-	-	-	3	7	10
Knowledge sharing in online health communities: A social exc ...	2016	-	-	-	-	-	-	-	2	12	26	49	89
Inter-organizational knowledge sharing system in the health ...	2015	-	-	-	-	-	-	-		1	-	-	1
Factors instead of demographic characteristics related to nu ...	2015	-	-	-	-	-	-	-	1	-	2	1	4
Efficacy ofknowledge transfer and exchange between CHWs and ...	2014	-	-	-	-	-	-	-		1	-	-	1
Discovering health-related knowledge insocial media using e ...	2013	-	-	-	-	-	1	6	2	8	1	2	20
Domain specific search in indian languages	2012	-	-	-	-	-	1	1	-	1	1	1	5
An overview of electronic health information management syst...	2012	-	-	-	-	2	2	-	-	-	-	1	5
Service and model-driven dynamic integration of health data	2011	-	-	-	-	5	2	-	-	1	-	-	8
Automatically estimating the incidence of symptoms recorded ...	2011	-	-	-	2	3	-	-	2	-	-	1	8
A semantic web application	2011	-	-	-	-	1	-	1	1	1	-	-	4

Documents		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
framework for health systems inte ...													
An overview of electronic health systems development &:amp; i	2011	-	-	-	1	3	3	1	1	-	-	-	9
Assessing schizophrenia with an interoperable architecture	2011	-	-	-	-	1	-	-	-	-	-	-	1
Toward semantic web based knowledge representation and extra	2011	-	-	-	-	1	1	1	-	3	1	-	7
HealthTrust: Trust-based retrieval ofYouTube's diabetes cha ...	2011	-	-	-	-	3	1	-	-	1	-	-	5
Managing interoperability and complexity inhealth systems: M ...	2011	-	-	-	1	-	-	1	-	-	-	-	2
Health conversational system based on contextual matching of...	2011	-	-	-	4	-	1	-	-	1	-	-	6
A platform to study the quality of life in oncology patients	2011	-	-	-	-	-	-	3	2	1	-	1	7
Learning before, during and after: Applying knowledge manage	2011	-	-	-	1	-	-	-	-	-	-	-	1
Design of equipment health management information system	2011	-	-	-	-	-	-	-	1	-	-	-	1
Augmented reality applied to the teaching/learning environme ...	2011	-	-	-	1	1	-	-	-	-	-	2	4
An example ofthe use of Public Health Grid (PHGrid)Technol ...	2011	-	-	-	-	-	1	-	-	2	-	-	3
Communicating about	2011	-	-	-	2	1	1	3	1	2	1	1	12

Documents		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
organizational culture in lhe briefing p ...													
Continuous control monitoring-based regulation: A case in th ...	2011	-	-	-	-	-	-	1	-	1	1	-	3
Unsupervised public health event detection for epidemie inte ...	2010	-	-	1	3	4	5	-	-	1	3	-	17
A secure pervasive health care system using location depende ...	2010	-	2	-	-	1	-	-	-	-	-	-	3
Combining ontologies and cognitive engineering to innovate e ...	2010	-	-	-	-	-	1	-	-	1	-	-	2
A distributed, service-based framework for knowledge applica ...	2009	-	-	-	1	1	-	-	-	-	-	-	2
Semantic web and knowledge management for the health domain:...	2009	1	6	3	1	3	1	6		1		1	23
	Total	1	8	4	**17**	**30**	**21**	**24**	**13**	**37**	**39**	**73**	**267**

Source: original source.

Annex II: Overview of document self-citation period 2009 to 2019

Documents		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Knowledge sharing in online health communities: A social exc ...	2016	-	-	-	-	-	-	-	-	-	1	-	1
Discovering health-related knowledge insocial media using e ...	2013	-	-	-	-	-	-	-	-	3	-	-	3
An overview of electronic health information management syst...	2012	-	-	-	-	-	1	-	-	-	-	-	1
Service and model-driven dynamic integration of health data	2011	-	-	-	-	4	1	-	-	-	-	-	5
Automatically estimating the incidence of	2011	-	-	-	-	-	1	-	-	-	-	-	1

Documents		2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
symptoms recorded ...													
An overview of electronic health systems development &:amp; i .	2011	-	-	-	-	2	-	-	-	-	-	-	2
HealthTrust: Trust-based retrieval ofYouTube's diabetes cha ...	2011	-	-	-	-	2	-	-	-	-	-	-	2
An example ofthe use of Public Health Grid (PHGrid)Technol ...	2011	-	-	-	-	-	1	-	-	-	-	-	1
Semantic web and knowledge management for the health domain:...	2009	-	-	2	-	-	-	2	-	-	-	-	4
	Total	-	-	2	-	**8**	**4**	**2**	-	**3**	**1**	-	**20**

Publishing Patterns of Health Informatics in Africa: A Bibliometric Analysis

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Abstract: This study investigates the publishing patterns of health informatics (HIs) in Africa, with a view to analyse the bibliometric growth. The application of HIs has played an important role in the advancements in medical practice and scholars/academics' teaching and learning at higher education institutions. The aim of analysing the volume of publications of HIs was to establish the research impact, visibility and output of academics, in order to promote scholarly communication and knowledge sharing, and contribute to existing knowledge in this field of study. Interpretive document analysis was applied to literature extracted from the Scopus database for the period between 1987 to 2018. The keywords entered for search engine optimisation were "Health Informatics" and "Africa". The duration of the study - from when data was harvested, collated and analysis to when the data was presented in tables and then discussed - was three weeks. The results obtained revealed that there were 2332 papers published within this period. The publications were communicated through different avenues, including articles, conference papers, review and others. Publications on medicine was at the top of the list of subject areas recorded. The top journal, where papers in HIs were published, is *Plos One*. South Africa was among the top countries that published research on HIs. In relation to institution affiliation, University of Cape Town was identified as the higher education institution that produced the highest number of publications, with 128 publications. In terms of funding bodies that supported research, thus leading to publication of papers in HIs, it was found that the National Institute of Health, South African Medical Council, United States Agency for International Development, Bill and Melinda Gates Foundation, National Institute of Allergy and Infectious Diseases, National Research Foundation played crucial roles.

Keywords: Publishing patterns, health informatics, information systems tools, bibliometric analysis, Africa

1. Introduction and conceptual background of the study

The primary focus of this study was to investigate the publishing patterns in the field of health informatics (HIs) in Africa, with emphasis on the growth patterns from 1987 to 2018. HIs field become important because it support the principle of accountability for better service delivery in healthcare system. Accountability ensures that healthcare professionals and scholars/academics apply fundamental knowledge and utilise up-to-date technologies when providing health care to ensure quality care and efficient service delivery in the health or medical sector. The field of HIs which is under the umbrella of health or medical practices, requires adequate knowledge and skills of the healthcare officer or medical practitioner. The essence of the knowledge in the healthcare environment is to make good use of the available health data combined with the information about patient. Healthcare professionals and scholars/academics in related fields have substantive and considerate empathy for people with health challenges, even though they are not supposed to. This was in relation to the calling which the profession of the healthcare or medical practices profess, where they go extra miles in fulfilling the obligations of quality service delivery. The healthcare or medical practices ensure this through end user of HIs documents of patients or individual concerned that require assistance or support (Al-Rowibah, 2019). Scholars/academics therefore consult documents in HIs, to assist in their research, as well as teaching and learning activities, in higher education institutions. However, many scholars/academics and healthcare or medical practitioners, who are supposed to be the end users of HIs documents, do not have access to published documents simply because they are accessible to them. This was one of the reasons the author of this paper was driven to investigate the publishing patterns of health informatics (HIs) in Africa, such that scholars/academics and healthcare or medical practitioners would know and have access to where information published and situated in HIs. Another justification that necessitated this study, for this researcher, was the expectation of promoting quality service delivery by healthcare or medical practitioners by exploring the efficacy of aligning health services with the use of technologies to assist in the diagnosis and treatment of different ailments. This is not possible without a vast knowledge of HIs, which can be accessed through application of technologies, as earlier mentioned. It was established that, since there has been a tremendous shift in healthcare or medical practices in recent times, scholars/academics and healthcare or medical practitioners need to be upskilled, in order to be prepared for unprecedented situations that would require their knowledge articulation (Ammenwerth, 2019; Sullivan, 2001). This tremendous shift has brought about the need for scholars/academics

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and medical practitioners to intensify their research skills and knowledge, such that, exploring different dimensions would not be a problem to them (Ammenwerth, 2019; Sullivan, 2001). Aziz (2015) notes that, in the past few decades, there has been an increase in the publication of medical information. This has brought about a tremendous growth in the scope of medical specialities and different sub-disciplines. This was to advance the quality of service delivery in the healthcare profession. In order to harness emerging information or knowledge in healthcare or medical practices, medical practitioners and scholars/academics would need to access this knowledge to strengthen practices and their research, as well as teaching and learning. Thus, advancing track record that would build up to speed with the latest medical knowledge, inclusive of HIs, required to assist medical practitioners and scholars/academics in the execution of their job (Aziz, 2015).

Based on the author's exposition and experiences, certain decisions made by medical practitioners and/ or scholars/academics are determined by the data, information and knowledge at their disposal or they possess. This could have been obtained through published resources in HIs databases. Therefore, to harness the data, information and knowledge in HIs, the need to make available, accessible and use the publications in HIs become essential, hence the interest of the researcher in this study. This study unveils the increase in availability of HIs, in relation to other areas of study, such as human-computer interactions, data mining, healthcare management systems, among others.

The consideration of African continent in this study by the author of this paper, was due to the adequacy of many mineral resources (Mapping Africa's natural resources, 2018). The availability of such vast mineral resources should ensure the creation of a conducive environment for the citizens of Africa equal to that experienced in the developed world such as the USA, Canada, Europe, UK, New Zealand just to mention a few. Unfortunately, one of the best places where development has taken effect, to some extent, is South Africa (the "Europe of Africa"), but in other African countries, development, specifically with regard to infrastructure, is still in its infancy in many parts of the continent. The essence of the effect of the infrastructure was to enhance publication growth of scholars/academics and medical practices required to support citizens in their different areas of specialisations.

The author felt that considering how resourceful or rich, the African continent is, compared to the developed world, their healthcare system has not support service delivery as expected and scholars/academic in terms of publication growth in HIs areas of study. The resources in Africa could be used if adequately harnessed, to expand higher education institutions for better teaching and learning outcomes in medicine, computer technology, information science and knowledge management. Besides, the land in Africa could be developed, in terms of farm agriculture/cultivation, to enhance the living standards of her citizens. The monetary value that should be gained from its mineral resources should cater for the basic needs of citizens in all the fifty-four countries in Africa, including the provision of services, such as education and health care, and infrastructural development through investment in the construction industries and many more activities and development initiatives in these countries. The author of this paper is seeking for answer on why the scenario of the continent is still like this, hence this research investigation. This research paper could serve as an eye opening to other scholars and stakeholders in various organisation and related institutions. This they could do through proper engagement in interaction with scholars and medical practitioners, on writing a proposal or framework that could address issues of support in ongoing research in HIs in Africa. Drawing analogy from the above emphasis, specifically in the area of HIs in Africa, most of the research work published are not easily accessed, since some of them may not have been published in textbooks or entered into online databases. However, HIs might be a resource that is required in higher education, to educate health professionals in different capacities. Besides, some of the journals that publishes HIs in the fifty-four (54) countries in Africa are not online or not recorded on indexed databases. This might also pose a challenge on how HIs publication could be harness and harvested. Although substantive research in HIs across the globe and, specifically, in Africa has been investigated. The documentation regarding such bibliometric analysis has not be done hence this study seeks to ascertain the growth, trends and visibility of research outputs in HIs and the impact this has had in Africa.

HIs, according to different scholars, is a multidisciplinary field of study (Kazemi, n.d.; Al-Rowibah, 2019; Ammenwerth, 2019). It is an interdisciplinary field that has its origin in medicine, computer technology and information science. From this multidisciplinary field, other sub-divisions developed, which include bioinformatics, medical informatics, clinical informatics, nursing informatics, biosciences, healthcare informatics and knowledge management (Kazemi, n.d.; Al-Rowibah, 2019; Ammenwerth, 2019). A study by Ammenwerth (2019) alludes that, HIs is concerned with the application of computers and other related digital technologies,

to assist in the gathering, processing, storage and use of information, to advance the techniques and procedures utilised in healthcare service delivery. Drawing inference from the Health administration degree program (n.d), it could be established that, HIs is an evolving field, exclusive to the medical profession. It entails different technologies and communication facilities that are required for healthcare services, to ensure optimal outcomes in patient care. The different areas mentioned make use of the resources of data, tools, procedures and strategies for optimum processes of acquisition, storage, retrieval and use of information and data in healthcare service delivery, management and planning. Al-Rowibah (2019) asserts that, HIs has dual understanding: scientific and information science. The former, is concerned with technical integration of reasoning, where information is used to process and communicate healthcare practices based on the training and research carried out through the support of technologies. While the latter, advocates for management operations of health data and information through the application of computers and related technologies (Al-Rowibah, 2019). These are used to advance the delivery of healthcare services, specifically in regard to the diagnosis of diseases and other activities that require research investigations. The tools in question are computer, magnetic and optical lens (Al-Rowibah, 2019). The data, information and tools used are appropriated in a variety of ways to enhance the method of approach in handling patient issues and research investigations within and outside hospitals and organisations. The author of this study believes that the changing nature of medical practice today, and the complexity of some ailments, requires adequate health knowledge and the application of the most recent technological tools in order to diagnose and cure such ailment, timeously.

An analysis of publications in HIs would be valuable to medical practitioners and researchers/academic scholars in the field of computer science, healthcare and information science, among others, to able to determine the publication trends in these areas. The goal of the study was to have identify the available data and publications in these areas and used them for decision making and planning. The author notes that the specialised subject areas are interweaved with components of data, information and technologies that could be used to drive their discipline. The utilisation of these variables (data, information and technologies) become vital considering the evolving nature of the knowledge required in solving problems in healthcare. Although HIs is still gaining momentum in the African context, but it is believed that many academics/scholars and healthcare or medical professionals are not passionate about digging deep into new knowledge, hence the slow growth of its knowledge cycle. However, digging deep into new knowledge has the capacity to strengthen current knowledge, as it is a key driver in present knowledge economy that underscores service delivery in healthcare or medical practices. This paper aims to address the knowledge gap in literature regarding HIs, methodological approach, contextualisation, and application of knowledge and skills in quality service delivery in healthcare profession.

HIs that are significant to this study is shown in figure 1 and 2 below. The related fields of study associated with HIs indicated in this study, is based on the research by Kazemi (n.d), Al-Rowibah (2019) and Ammenwerth (2019), where HIs is linked to computer science, information science and healthcare. The reason for this explanation was the nature of the intertwined components of data, information and technologies associated to computer science, information science and healthcare. The above-mentioned fields of study use data, information and technologies in their daily operations. The utilisation of the variables (data, information and technologies) has become vital in healthcare, higher education institutions and other related institutions. It is envisioned that, if consideration is given to the value that can be gained from a combination of niches in the associated fields, it would result in the transformation of operations that occur on a daily basis in healthcare or medical practices. The author of this paper made a clear distinction in fig 1 and 2, showing that, when addressing issues in healthcare, what is paramount is prevention, treatment and management of illness. These cannot be solved or attended to without the use of data, information and technologies. They are used by healthcare professionals on daily basis, to make assessments, diagnoses and to investigation difficulties in medical practices. In this regard, there is no organisation in present day information and digital economy, which can do without the support of considerable computer science, information science and other related technological tools. The link between how computer becomes a major influence on human become a significant interplay on data gathering, processing, storage, and use for the purpose of diverse activities both in academia and healthcare system environment. The author notes that, the integration of data, information and technologies, which encompasses the three threshold of healthcare, information science, and computer science was to unveil the mystery that sustain the improvement of quality service delivery in healthcare profession.

The essence of this research, as shown in figures 1 and 2, was for scholars in African organisations to understand where these three fields interlink and how they support each other in different research undertakings. The presentation in figure 2 indicates the various fields associated with health informatics, namely bioinformatics,

medical informatics, clinical informatics, nursing informatics, data mining, biosciences and healthcare informatics (Kazemi, n.d, Al-Rowibah, 2019; Ammenwerth, 2019). This inspired the author of this paper to embark on this study, since HIs is a growing multidisciplinary field that could give birth to new and diverse areas of learning in the present-day knowledge evolution in Africa.

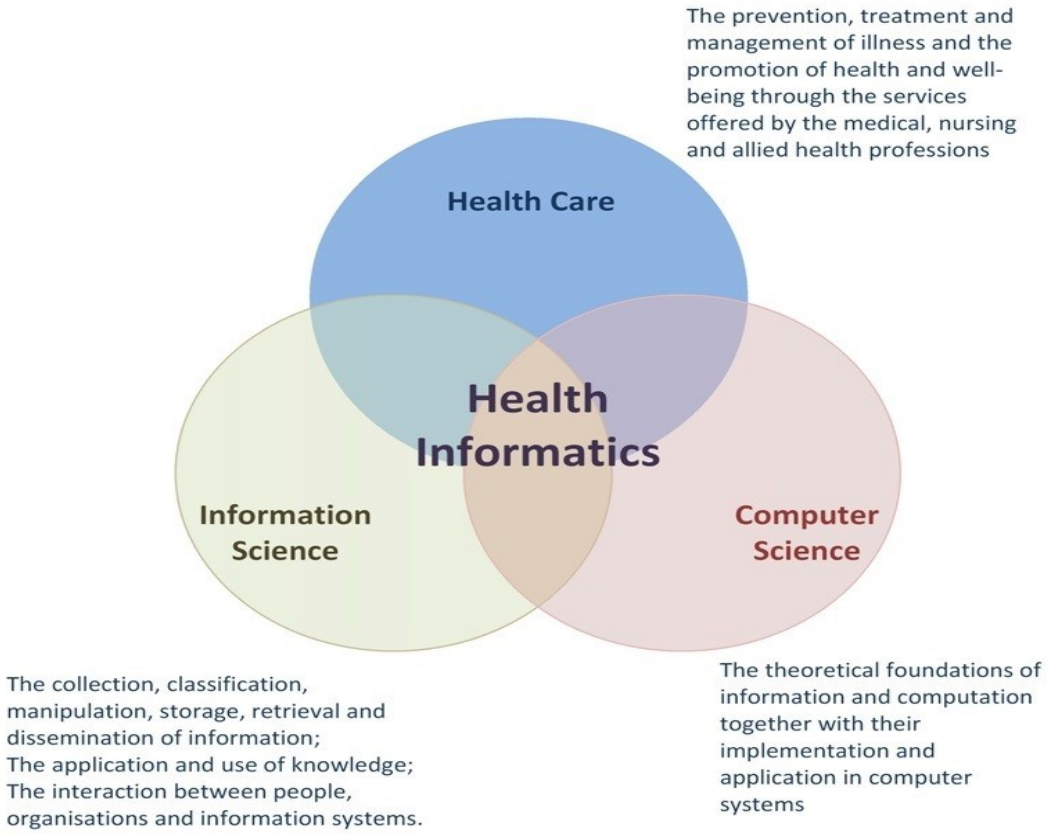

Figure 1: Health informatics and related fields of study

Source: https://www.quora.com/What-is-Health-Informatics

Figure 2: Health informatics and related fields of study

2. Literature review

In the world of academia, much attention is given to research activities, which eventually result in the publication of research articles. The attention given to research activities has made research institutes and related teaching and learning organisations to apply the use of data, information and digital technologies as key to survival of best practices. The justification is that best practices in the medical field require extensive research and the application of the latest technological tools, which, in turn, should result in articles that are published in journals. The reflection on HIs made the author of this paper to unveil the status of health system in Africa. The essence of brining in the issue of health status in Africa was to have a clear picture of the scenario of health system in Africa, so that, dealing with HIs would not be misleading. It is obvious that several nations, across the world, are faced with diverse health challenges. This made Oleribe et al. (2019) make reference to some the challenges faced in the health system in Africa, which vary from one country to another, as emphasised with consideration to human development index (HDI). Many of the countries in Africa, over the years, have experienced different problems that include inadequate manpower and technological tools as well as the challenges caused by a lack of financial, institutional technical support and instability due to political developments (Oleribe, et al. 2019). These has affected the appropriate governance of the health system of many nations in Africa. Petersen, Marais, Abdulmalik, et al. (2017) referred to other factors that have contributed to poor service delivery in the healthcare system includes scarcity of healthcare professionals and technological tools/system support, finance and leadership. These have a great impact on the quality of healthcare services rendered to citizens. Marais and Petersen (2015) indicate that, the healthcare system has suffered a lot of challenges due to neglect and poor funding, thus leading to unforeseen challenges across diverse countries in Africa. This led to the World Health Organization (WHO) (2007) reemphasising to governments to focus on their attention on some of the factors mentioned by Marais and Petersen (2015) as they are critical in strengthening any economy health system. Based on the emphasis made by WHO (2007), the right knowledge and technological tools that could support the health system of any nation becomes essential, hence this paper, which address HIs (Al-Rowibah, 2019).

Related studies in health and the medical field, specifically focused on bibliometric analysis, has been carried out by Sullivan (2001), Onyancha and Ocholla (2009), Glover and Bowen (2004), Rotich and Onyancha (2016), Chuang, Chuang, Ho and Ho (2011) and Macías-Chapula and Mijangos-Nolasco (2002); however, none of these considered HIs as a related field of study. The quantity apportioned to publication of articles in a particular field varies in context, subject and phenomenon. Several studies by Araújo, Moreira, Furtado, Pequeno, and Andrade (2014), Baby and Kumaravel (2012), Egghe (2010), Naranan (1971), Ruiz-Castillo and Costas (2014), Schorr (1974), Sudhier (2013), Suen and Yang (2012) and Torbati and Chakoli (2013) gave widespread explanations over the disparity of research output patterns and visibility of authors' research work. A follow-up research by Onyancha (2010), indicates that publication counts and analysis are progressively flattering to the global setting such that, in-depth meter of research output is counted through bibliometric analysis. The outcome of such mapping is based on a specific field where scholars' work show great significance. Therefore, this study focuses on bibliometric research methods that examine publishing patterns of health informatics in Africa, between 1987 and 2018.

This research is believed to contribute to systematic policy and research organisation in terms of inclusivity in education, knowledge sharing among researchers/scholars in specific field of study. The study would add value to the strength of scholarly communication and visibility of research output over these years, 1987 to 2018, among academics and medical practitioners. This made Nwagwu (2006) notes that, similar studies in bibliometric has extended outside the range of publication analysis, especially in the developed world. Although some societies are yet to partake in its utilisation for strategic assembling and planning. The data and information harvested have become useful for research and other work in academia. The author of this paper contemplated on why healthcare professionals and associated scholars in Africa are no longer passionate about digging deep into new knowledge. Possible reasons could be that there is no propelling force, no incentives, no conducive work environment and possibly no facilities. Therefore, to actualise this, individuals in this healthcare and medicine need to be encouraged to actively source the information, data and technologies required in healthcare services. Through the support of technologies, the required information or data can be obtained from different sourced, processed, stored, retrieved and utilised for patient diagnosis (Healthcare Administration Degree Programs, n.d).

In light of the above, the author of this study concluded that HIs is an interdisciplinary area of study that trails the active use of biomedical data, information and know-how for systematic inquiry in order to solve human

health situations and to make concrete decisions to advance daily living. HIs is not concerned with the use of the technological tools only, rather it advances quality healthcare delivery through proper adherence to policies, acquisition and accessibility, and the monitoring and maintaining those technological tools required to care for the patient and other related work in healthcare organisations (Ammenwerth, 2019). The application of different procedures for the gathering of information could be used within and outside healthcare institutions. The application of HIs became necessary due to different ailment affecting human beings today around the world and specifically in Africa. The desire for in-depth knowledge in HIs has made researchers and scholars strive to find better ways to articulate and handle job specifications in the world today. Many healthcare organisations and higher education institutions in Africa, where medical practitioners are trained, have adopted the application of HIs in their operations and service delivery. This was to advance best medical practices and teaching and learning carried out in these institutions.

Ammenwerth (2019) emphasises that the formation of knowledge in HIs among scholars could propel how efficient and effective they were in provision of quality services to human being in general. Evidence-based research by Park (2016) and Turner, Kushniruk and Nohr (2017), and Ammenwerth (2019) indicate that HIs serves as interference for healthcare and in bio-medical domains where health professionals and scholars progressively advance their practices for improved patient care through a number of digital information systems. The information systems tools in question comprises artificial intelligence, robotics, the Internet of Things, smartphones, electronic medical records, portable medical devices and wearable computing, among others. These technological tools are used by physicians and other scholars to harvest the data and information required for further collection, analysis and exchange, for the purpose of delivering quality services. Technology has made life much easier for health professionals and scholars, such that, they no longer struggle to interpret data and information collected to enhance their service delivery (Park, 2016; Turner, Kushniruk and Nohr, 2017; Ammenwerth, 2019). To this end, medical practitioners and other scholars in related fields could apply their experiences and knowledge to answer difficulties in health issues. With HIs, it is possible to identify tendencies that could have brought about a scenario and it proposes insights on how the health condition of the individual could be addressed. It progresses from generating information and data through diagnosis and different test analysis, in order to reduce costs and medical error (Ammenwerth, 2019). Apart from medical practitioners, pharmacists, bioinformatics and life scientists, who uses different tools in carrying out series of medical test in the hospital, academics now fully deepened on them in their research investigation. The author of this study emphasises that, HIs is of importance to humanity, thus, creating an opportunity for maintenance culture that propels the use of technological tools to advance research and support medical practices in Africa and globally. Although, this maintenance culture practice is still a challenge in Africa. The maintenance culture practices can be actualised through first reading or studying the manual of the various tools and gaining an understanding of how the tools could be used by any individual and what it is used for.

The job descriptions associated with the various HIs applications range from the requirement of data filtration, assembly, handling, modelling, software development, repairs of clinical databases, execution of health IT software tools, continuous training and re-training of professionals (Turner, Kushniruk and Nohr, 2017). Turner, Kushniruk and Nohr (2017) further note that data analytics are now part of HIs, thus, drawing distinction on management operations of how valuable data and information is to services carried out in the hospitals. This does not mean that those without knowledge of or a background in computers cannot migrate to HIs, all that is required is determination and regular training in order to adapt to and adopt the ethical protocols and practices. The understanding of the authors with regard to the technological tools used in HIs is that, when diagnosing a patient with an ailment, for example, asthma, the health professional makes use of the tool to find out how the symptom could be traced and treated (Sullivan, 2001). This is also applicable to other ailments such as HIV, tuberculosis and cancer (Sullivan, 2001). The tools for different ailments or diseases differ as well. Therefore, HIs tools are also used to do follow-up diagnoses (Sullivan, 2001).

HIs, as mentioned earlier, has had a significant and transformational impact on healthcare service delivery across the globe, in diverse contexts (Greenes and Shortliffe, 1990; Smith, 1997; Morris and McCain, 1990; Detmar, 2000; Tierney, 2001; Park, 2016; Turner, Kushniruk and Nohr, 2017; Ammenwerth, 2019). The transformational and significant differences are centred on the efficiency and effectiveness of the tool, combined with the experience and knowledge of the health professional, which are harnessed to diagnose an ailment; allows for the easy capturing and retrieval of patient data on electronic databases; a practical presentation and integration of information to interpret patient problems; minimises the workload required to search for relevant materials, the prescription of medications issued to the patient and confirmation of when next to visit the hospital again

due to the application of the HIs medical tools (Greenes, 1990; Smith, 1997; Morris and McCain, 1990, Detmar, 2000; Tierney, 2001; Park 2016; Turner, Kushniruk and Nohr, 2017; Ammenwerth, 2019). The authors established that the utilisation of computerised systems in any health institution and related organisation would improve the work performance of both physicians and academics/scholars. Therefore, a bibliometric analysis of HIs in Africa could assist massively, contributing to improving services in the healthcare sector. There is no nation in the world that do not pay attention to quality healthcare services, especially consideration to cost-effectiveness on human fitness. This was based on personal observation and experiences of the author in the context of Africa. Many people in Africa are still ignorant of what to do and possibly where to go when they are faced with health challenges. Studies by Ebermann (2016); Sodi, Mudhovozi, Mashamba, Radzilani-Makatu, Takalani and Mabunda (2011) and Owusu-Ansah and Mji (2013) indicate that the use of indigenous knowledge (IK), or herbal treatment, is still very prominent in many African communities. This is another indication of why this present study require broader strengthening and engagement in dialogue with health practitioners and scholars on best practices in healthcare service delivery being promoted in Africa. Although IK regards herbal treatment as useful and best practices in medical treatment. Therefore, it should not be undermined, as there are indications of proof in sustainability of healthcare services. This could result in test and verifiable analysis that can be carried out by health practitioners.

3. Purpose of the study

The purpose of this study was to apply bibliometric research strategies to investigate the publishing patterns of health informatics study in Africa, in the last thirty-one years, 1987 to 2018. This was guided with the following specific research objectives:

- analyse publication counts, by year, between 1987 and 2018
- identify the avenue through which HIs publications were communicated
- categorise the distribution of HIs records by authorship
- identify the top producing authors in HIs and their different subject areas
- find out the top journals where HIs papers are published
- identify the top subject areas publishing HIs papers in Africa
- classify the country and institutional affiliation that publishes HIs papers in Africa
- identify the funding bodies responsible for HIs publishing in Africa

4. Research methodology

Presently, in research investigation, different approaches are applied to harvest research data from databases. This phenomenon of harvesting data from databases is associated with bibliometric analysis of publication and their citation impact is of immerse significance to scholars and the results of various studies. This type of research, where the researcher has to do a lot of searches when making inquiry about a particular phenomenon, can be likened to the exploratory research approach (Saunders, Lewis and Thornhill, 2009). The exploratory process leads to the gathering of information based on certain ideas that the researcher has in mind. The essence of the exploratory process makes reference and citation of publication, where distinction on certain research work has been carried out over a period of time. The purpose of analysing the HIs publications was to establish the research impact, visibility and output of academics. This would help promote scholarly communication, knowledge sharing and contribution to existing knowledge in the particular field of study. The basis was to ascertain whether the area of study is advancing or retarding and, if so, to offer solutions. The Scopus database was used to extract documents (data) on HIs studies in Africa, from 1987- 2018. The study covered a period of thirty-one (31) years of published articles in HIs, in Africa. During the course of the search strategy, the author applied the search option of “Health Informatics”, and “Africa”. The duration of the study was three weeks, from when the data was harvested and collated to when it was analysis, presented in tables and discussed. The results obtained showed that there were 2332 documents or research papers published over this period. The Scopus database was used because there is no actual local database that indexes literature in the field of HIs in Africa. Scopus is the second largest database that houses documents in library and information science area of specialisation where HIs studies is resident. The use of Scopus for extraction of data or published works/documents on HIs became necessary, since many scholars have also worked on this related field of study, as mentioned above.

5. Results

The results obtained from this study was based under the following subheadings:

- publication counts by year from 1987 to 2018

- avenue through which publications in HIs were communicated
- records by authorship
- top producing authors in HIs and their subject area
- top journals where HIs papers are published
- productivity by country and institutional affiliation
- funding sponsor

5.1 Publication counts by year from 1987 to 2018

The publication counts, from 1987 to 2018, measured in various document types in Scopus databases resulted in 2332 research output. This indicates that the number of HIs articles published in Scopus journals were 2332. The line graph, in figure 1 below, indicates that between 1987 to 2002, there was not a significant increase in the number of publications in HIs in Africa. It can be deduced that this was due to a scarcity of information regarding this area of specialisation in Africa. Although, it is possible scholars where involved in research activities, their work was not visible online. Interestingly, a changed occurred immediately after 2002 to date, as represented below. This shows that scholars are now publishing in this area and that their work is also visible online. Sometimes, it is difficult to ascertain the extent to which research work is on-going when there is no reporting on those studies. The author's research affirms that, not all journals published by higher education institutions and other bodies are published online. In this regard, it becomes difficult and, sometimes, even impossible to harvest those resources published in hard copy. The Scopus databases is only able to harvest resources published online and also those indexed by the Scopus database.

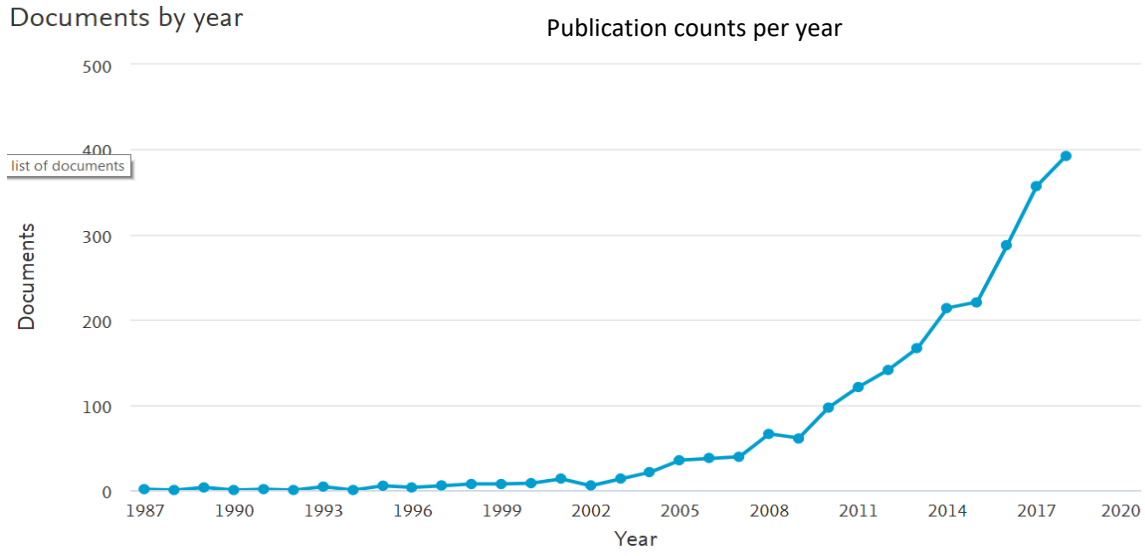

Figure 3: Publication counts per year

5.2 Representation of publications by year through percent

The results obtained in this segment were measured in their numbers of publication and percent. Table 1 shows that in the years 1980, 1990, 1992 and 1994, there were no publications on HIs research recorded. However, the most interesting part is the results obtained between 2004 and 2018, which were very encouraging. The findings were as follows: 2018= 393 (16.85%), 2017 =357(15.31%), 2016 =287 (12.31%), 2015 =221(9.48%), 2014 =214(9.18%), 2010 = 97 (4.16%), 2009 =61 (2.62%), 2008 = 66 (2.83%), 2007 =39 (1.67%), 2006= 37 (1.59%), 2005=35 (1.51%), 2004= 21 (0.90%). This indicate that, HIs areas of study is advancing progressively. The reason could be attributed to many scholars publishing in this area of study, as more awareness are being created in the underlying information science discipline.

Table 1: Publication counts per year Scopus (N=2, 332)

Publication year	Record count	%
2018	393	16.85
2017	357	15.31
2016	287	12.31
2015	221	9.48
2014	214	9.18
2013	167	7.16
2012	141	6.04
2011	121	5.19
2010	97	4.16
2009	61	2.62
2008	66	2.83
2007	39	1.67
2006	37	1.59
2005	35	1.51
2004	21	0.90
2003	13	0.56
2002	5	0.21
2001	13	0.56
2000	8	0.34
1999	7	0.30
1998	7	0.30
1997	5	0.21
1996	3	0.13
1995	5	0.21
1994	0	0.0
1993	4	0.17
1992	0	0.0
1991	1	0.04
1990	0	0.0
1989	3	0.13
1988	0	0.0
1987	1	0.04

5.3 Avenue through which publications were communicated

This segment considered the avenue through which publications were communicated over the thirty-one years (1987-2018) of bibliometric analysis of articles harvested from the database. The results obtained indicate that research articles 1562 (66.98%), published in journals, was the highest; followed by conference papers, with 394 (16.89%); reviews, with 224 (9.61%); book chapters, with 58 (2.49%); and then editorial papers. Letters, conference reviews and short surveys were minimal. It therefore means that the majority of the research in HIs are presented in research articles, conference papers and reviews. The reason could be that most of the scholars in this area are academics and medical practitioners. It is likely that recent research findings on topical issues would appear in research articles, conference papers and reviews. More importantly, since HIs is associated with medical practices, there are many activities which could propel individuals to be active in writing and who would also want to promote scholarship and knowledge sharing. It is not out of place if people do not want to communicate their work in book chapters, editorials, letters, conference reviews and short surveys. Sometimes, book chapters, editorials, letters and short surveys are not fully recognised by institutions, compared to articles and conference papers. In recent times, articles and conferences papers are rated as the major platforms for academics and scholars to earn points regarding promotion criteria and the increase in the number of papers can also be attributed to collaborative efforts.

Table 2: Avenue through which publications were communicated Scopus (N=2, 332)

Avenue	Record count	%
Article	1562	66.98
Conference paper	394	16.89
Review	224	9.61
Book Chapter	58	2.49
Note	20	0.85
Book	17	0.73
Editorial	15	0.64
Letter	14	0.60
Conference review	12	0.51
Short survey	9	0.39
Erratum	2	0.09

5.4 Records by authorship

The findings presented in figure 2 indicate that, between 1987 and 2018, Tomlinson was at the top of the list of published authors, with 26 publications, followed by Hay (25 publications), Farzadfar (21 publications), Wools-Kaloustian (21 publications), Lopez (19 publications), Murray (19 publications), Tierney (19 publications) and Yonemoto (19 publications). The findings show that, to have an adequate number of papers published depends on several factors, such as a conducive working environment, including an office space; funding to attend conferences/workshops and seminars; access to internet facilities; a good collaboration team and drive from the individual researcher. One would expect that, over time (in this case, 31 years) there would have been a substantive number of quality papers published. However, based on the author's own experience, many academics are not driven when it comes to research activities, as it takes a lot of rigour and interest to produce research papers. Importantly, many academics are emerging researchers, who require mentorship and support from their peers and organisations.

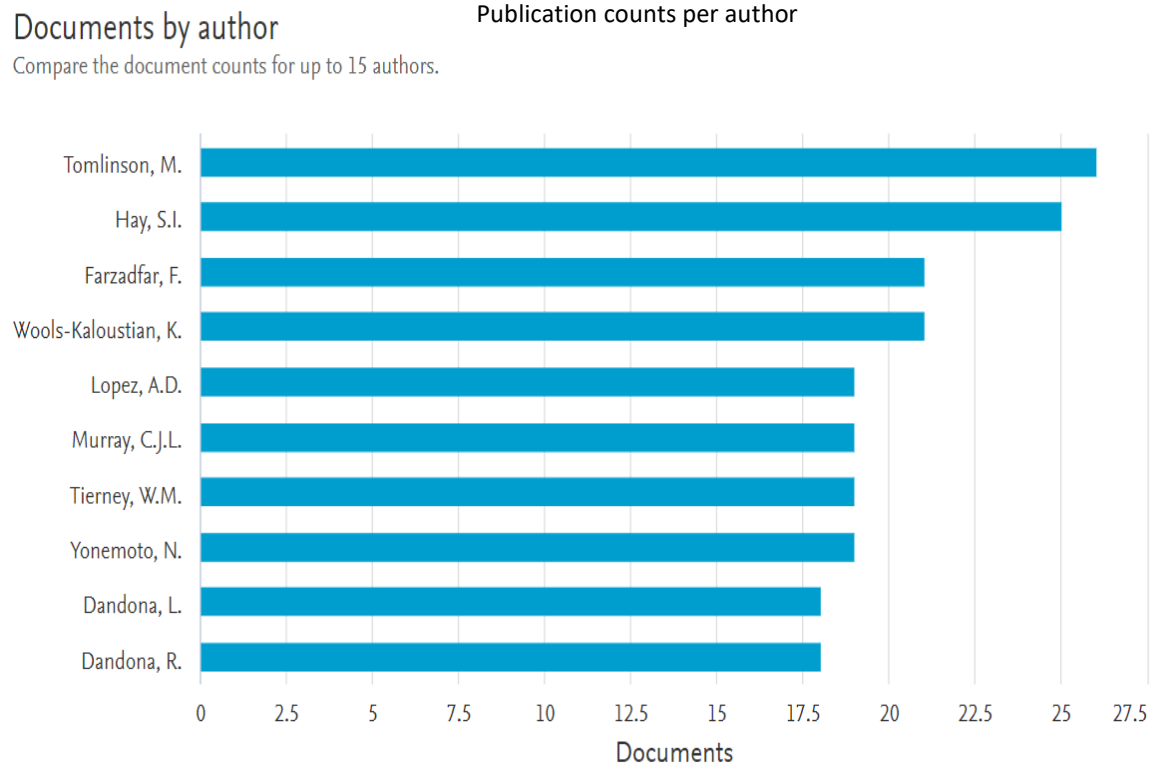

Figure 4: Documents by authors

5.5 Top producing authors

This section establishes the top producing authors in HIs research publication between the period, 1987 to 2018, which is the focus in this investigation. The results in table 3 indicate the top producing authors as far HIs publications is concerned, namely Tomlinson (26, 1.11%), Hay (25, 1.07%), Farzadfar (21, 0.90%), Wools-Kaloustian (21, 0.90%), Lopez (19, 0.90%), Murray (19, %), Tierney (19, %) Yonemoto (19, %), Dandona (18, 0.77%), Gething (18, 0.77%), Kengne (18, 0.77%), Khang (18, 0.77%), Rafay (18, 0.77%), Salomom (18, 0.77%), Terkawi (18, 0.77%) and Ukwaja (18, 0.77%). These publications were achieved through the effort of the authors, either individually or through collaborative efforts, in their different areas of specialisation. Many of these authors had to invest a considerable amount of time, effort and patience to ensure that their papers are published in reputable journals. Publishing research papers is part of the responsibility of academics in order to promote scholarship and knowledge sharing. They are also required to publish before they can be assessed and considered for promotion. The author expects that there were certain requirements that these academics would have had to embark on their research project, like the provision of internet facilities, a workable office space and other support from their organisation.

Table 3: Top producing authors from1987-2018 Scopus (N=2, 332)

Authors	Record count	%
Tomlinson	26	1.11
Hay	25	1.07
Farzadfar	21	0.90
Wools-Kaloustian	21	0.90
Lopez	19	0.81
Murray	19	0.81
Tierney	19	0.81
Yonemoto	19	0.81
Dandona	18	0.77
Gething	18	0.77
Kengne	18	0.77
Khang	18	0.77
Rafay	18	0.77
Salomom	18	0.77
Terkawi	18	0.77
Ukwaja	18	0.77

5.6 Top subject areas

The findings presented in figure 3 show that Medicine (35.9%) was at the top of the list of subject areas in the publications of HIs. The rest of the discipline had some components of HIs, such as Computer Science (10.2%), Social Science (9.5%), Biochemistry (6.1%), Engineering (5.6%), Agricultural (5.0%), Health profession (4.2%), Immunology (3.7%), Environmental Science (2.7%) and Business Management (2.6%), while unrelated discipline, "Others" accounted for 14.4%. A likely explanation for this is that HIs is associated with the collection of data and utilisation of technological tools. Several of the disciplines identified below form part of HIs and also make use of related research data and tools in their investigation and problem-solving mechanisms. Today, knowledge discovery, in any discipline, cannot be embarked on without the use technological tools in regard to data collection and processing, as well as the storing of data in order for it to be used for diverse research purposes. The author holds that, as different subject areas continue to emerge, the use of data and technological tools will be needed to advance transformation of job description and investigations.

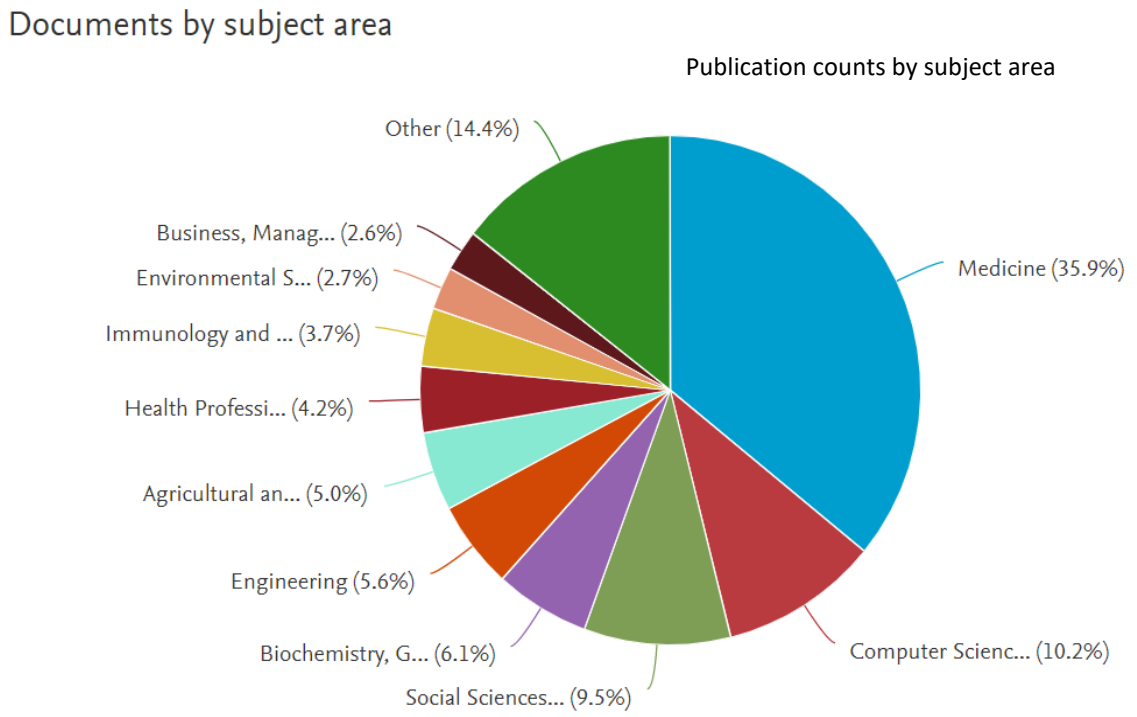

Figure 5: Document by subject areas

5.7 Top journals where HIs papers are published

In this segment, the author identified the top journals wherein papers in HIs were published. The findings indicate that these were categorised according to their ranking, as presented in table 4 below. *Plos One* (84, 3.60%) was the first, followed by *Lancet* (34, 1.46%), the *International Journal of Medical Informatics* (30, 1.29%), *South African Medical Journal* (26, 1.11%), *BMC Public Health* (25, 1.07%), *ACM International Conference Proceeding Series* (23, 0.98%), *BMC Health Services Research* (23, 0.98%), *Lecture Notes of the Institute for Computer Science* (21, 0.90%), *Informatics and Telecommunication Engineering* (21, 0.90%), *BMC Medical Informatics and Decision making* (20, 0.86%) and *Global Health Action* (20, 0.86%). It can be deduced that these journal publications are mainly focused on healthcare and medical practice. Interestingly, HIs is part of the health profession; hence, most scholars prefer to publish their work there. Journals in health area of specialisation are of great significance due to the evolving nature of research investigation and topical issues discussed in those areas. Another reason why scholars/academics or health professionals publish in some of the listed health journals below is due to their h-index factor, which measures both the productivity and citation impact of a publication. For scholars/researchers' work to be well rated and valued, it has to published in h-impact factor journals. The author also believe that it is imperative that, to stay relevant in a discipline, researchers have to stay abreast of recent trends and be seen to contribute to field through research and publishing in health-related journals, like some of those mentioned below.

Table 4: Top journals wherein HIs papers are published Scopus (N=2, 332)

Journals	Record count	%
Plos One	84	3.60
Lancet	34	1.46
International Journal of Medical Informatics	30	1.29
South African Medical Journal	26	1.11
BMC Public Health	25	1.07
ACM International Conference Proceeding Series	23	0.90
BMC Health Services Research	23	0.98
Lecture Notes of the Institutive for Computer Sciences	21	0.90
Informatics and Telecommunications Engineering	21	0.90
BMC Medical Informatics and Decision making	20	0.86
Global Health Action	20	0.86

5.8 Productivity by countries in Africa

The findings, as indicated in table 5, identified the various countries in Africa where publications in HIs are published. It can be seen that South Africa **(**923, 39.6 %) was at the top of the list with the highest number of papers published in HIs, followed by Kenya (181, 7.76%), Nigeria (141, 6.04%), Ghana (110, 4.71%), Uganda (110, 4.71%), Tanzania (85, 3.64%), Cameroon (67, 2.87%), Ethiopia (64, 2.74%), Malawi (56, 2.40%), Rwanda (51, 2.18%) and Zambia (48, 2.06%). While the countries with least number of publications in HIs are Lesotho (5, 0.21%), Niger (5, 0.21%), Liberia (4, 0.17%), Madagascar (4, 0.17%), Djibouti (2, 0.09%), Equatorial Guinea (2, 0.09%) and Chad (1, 0.04%). The findings were all categorised according to their ranking of production of papers by each country, as presented in table 5 below. The author assumes that countries like South Africa, Kenya, Nigeria, Ghana, Uganda, Tanzania, Cameroon, Ethiopia, Malawi, Rwanda and Zambia are at the top of the list because their governments support higher education institutions through the provision of adequate funding and infrastructural facilities; hence, the growth rate of research publications.

The South African government promotes a functional and active healthcare services, which drives an interest in healthcare research among many scholars and healthcare professionals. These assumptions are derived from the author's experiences and observations while studying towards his doctorate and living in South Africa for over seven (7) years. In the case of the countries where there have been limited publications, it could be that the government in those countries do not provide adequate funding for their higher education institutions and, therefore, these institutions are unable to attract researchers interested in pursuing research endeavours that would lead to published papers. It is also possible that some of the countries mentioned (Lesotho, Niger, Liberia, Madagascar, Djibouti, Equatorial Guinea and Chad) are still very backward in terms of growth, visibility, research output and development and in fostering scholarship; hence, the limited numbers of papers. The author also gathers that governments and higher education institutions in these countries would have challenges with regard to the provision of a conducive working environment, electricity, the internet and other ICT facilities that could support research and advance scholarship; hence, scholars/researchers do not have the drive to embark on research and publication. More importantly, the author concludes by suggesting that to advance scholarship, some of the factors previously mentioned, like policy implementation and the provision for a conducive environment and infrastructural support, must be provided in research investigation before advances can be made among scholars.

Table 5: Productivity by countries in Africa Scopus (N= 2,332)

Countries	Record count	%
South Africa	923	39.6
Kenya	181	7.76
Nigeria	141	6.04
Ghana	110	4.71
Uganda	110	4.71
Tanzania	85	3.64
Cameroon	67	2.87
Ethiopia	64	2.74
Malawi	56	2.40
Rwanda	51	2.18
Zambia	48	2.06
Egypt	43	1.84
Burkina Faso	38	1.63
Mali	36	1.54
Botswana	34	1.46
Mozambique	34	1.46
Congo	32	1.37
Zimbabwe	31	1.32
Benin	27	1.16
Cote d'Ivoire	22	0.94
Namibia	22	0.94
Tunisia	22	0.94
Senegal	17	0.73
Morocco	15	0.64
Gambia	13	0.56
Togo	13	0.56
DR Congo	11	0.47
Sudan	10	0.43
Sierra Leone	9	0.39
Angola	7	0.30
Burundi	7	0.30
Gabon	7	0.30
Swaziland	7	0.30
Libyan Arab Jam	6	0.26
Mauritius	6	0.26
Lesotho	5	0.21
Niger	5	0.21
Liberia	4	0.17
Madagascar	4	0.17
Djibouti	2	0.09
Equatorial Guinea	2	0.09
Chad	1	0.04

5.9 Productivity by institution affiliation

In order to ascertain the institution of affiliation that published in HIs, documents were segmented into bites and the analysed research publications further scrutinised. The results in figure 4 indicate that the University of Cape Town (128 publications) is at the top of the list in Africa, followed by the University of Witwatersrand (171), South African Medical Research Council (160 publications), University of Stellenbosch (152 publications) and University of KwaZulu-Natal (130 publications). The reason why these affiliated institutions were at the top is because they are top-rated institutions in Africa, with a high-impact factor when it comes to research and visibility of research output. Interestingly, these institutions are fully supported by their government, with adequate financial support and ICT facilities, which is required for any research activity. It can also be deduced that most of the scholars/researcher at these institutions collaborated with others within and outside of their institutions; hence, the increase in collaborative studies over the years. It can also be noted that there were affiliations with external institutions such as the London School of Hygiene and Tropical Medicine (90), Harvard Medical School (81) and Karolinska Institute (80). Research collaboration has become a mechanism of strengthening research and a means to address the needs of researchers, where there are limited resources,

made easier with the current technologies at the disposal of researchers at all institutions. These institutional affiliations have the added advantage of creating more visibility with regard to researchers' work, globally, and of having high impact within and across other institutions.

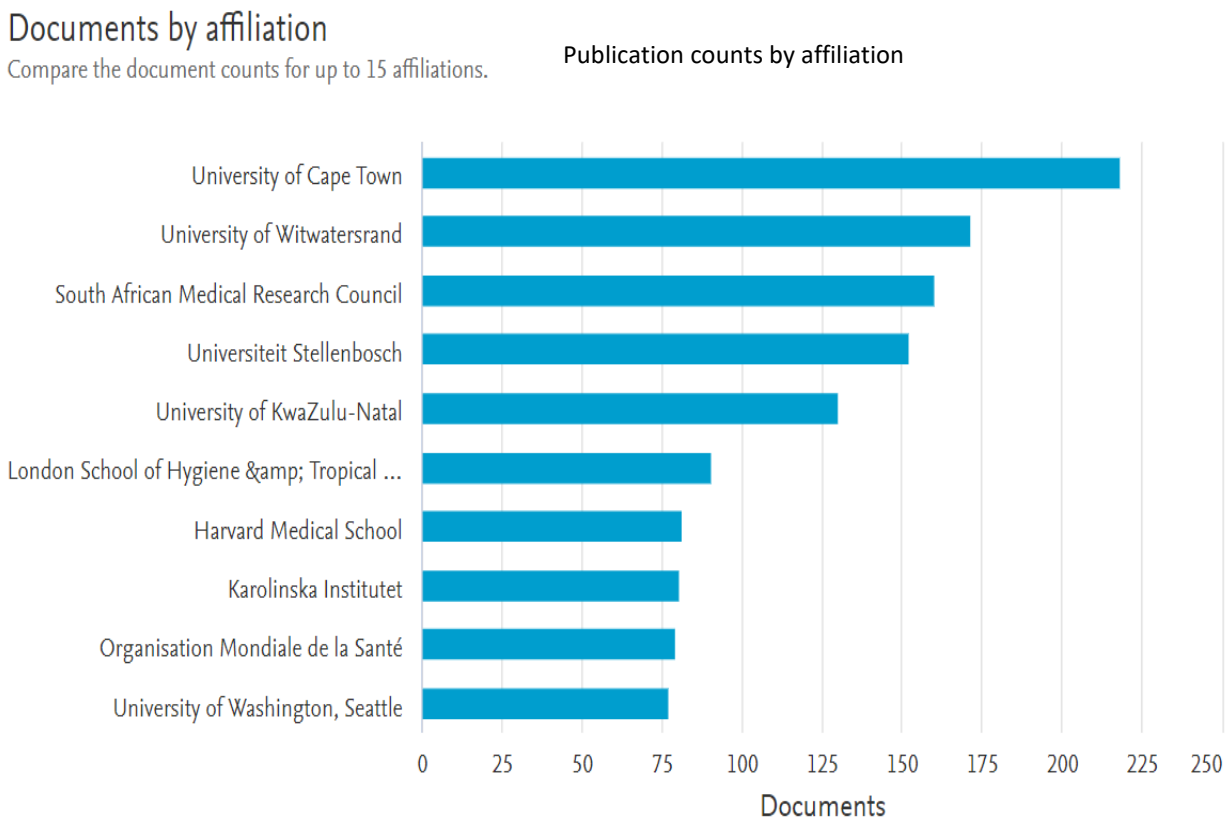

Figure 6: Productivity by institution affiliation

6. Funding bodies

This segment reports on the funding bodies within and outside of Africa that necessitated the possibility of publication of researchers in the areas of HIs in Africa. It can be noted, from the data presented in figure 5 below, that the National Institutive of Health was the top in the list of organisations that sponsored research activities that resulting in publications from institutions in Africa, followed by the South African Medical Council, United States Agency for International Development, Bill and Melinda Gates Foundation, National Institute of Allergy and Infectious Diseases, National Research Foundation, well come Trust, National Institute of Mental Health, Foundation for the National Institute of Health and Fogarty International Centre. The different organisations mentioned are international organisations or research-related institutions that support research activities in Africa. The nature of these organisations is such that they are also supported with adequate funding, including the governments in their various countries. Another point of emphasis is that many of the sponsored bodies are affiliated to international health institutions that promote scholarship and research activities across the world. Research activities is rigorous and without adequate infrastructural facilities and funding, it becomes difficult to engage in such an endeavour. Interestingly, due to engagement of and evolving nature of scholarship, many health research institutions are supporting research in order to arrive at new findings that would shape the society and create a better life for communities.

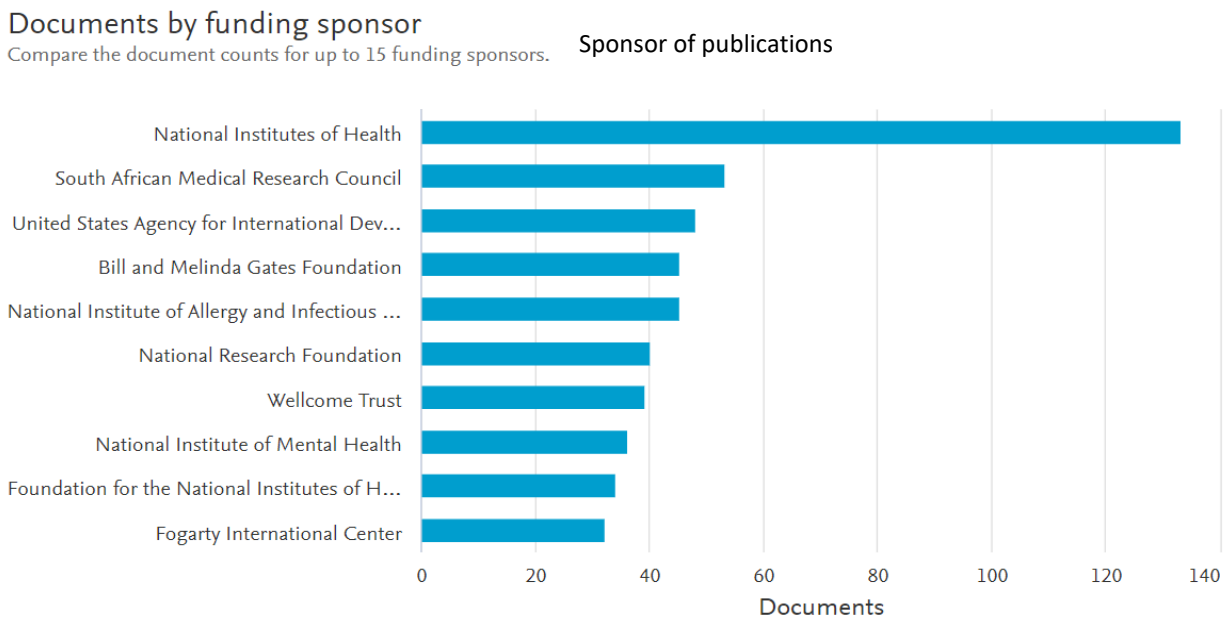

Figure 7: Funding sponsor

7. Discussion

The major focus of this study was to assess the publication patterns on the topic of HIs across Africa. This study succeeded in establishing existing gaps in the publications on HIs, published over the past thirty-one years, between 1987 and 2018, in Africa. The efficacy of HIs knowledge has become important in the considerations of health interventions for humankind across the world. The methodological approach was another important factor, as not all research considers harvesting data from databases such as Scopus and related scholarly sources. The reason behind this is that not all African journals are visible on this online platform. Therefore, the need to evaluate their sources becomes crucial. Presently, there is a growing trend to also give recognition to HIs papers produced in Africa, as shown in table 1. Based on the analogy of empirical studies by Al-Rowibah (2019), Ammenwerth (2019) and Araújo et al. (2014), it was noted that, HIs encompasses healthcare services, which account for other unprecedented areas of endeavours.

The results of this study indicate that there has been a tremendous shift from 2002 till 2018. This could be because the field of HIs is becoming well-known and scholars/academics have shown more of an interest in this field. It is likely that some scholars/academics in Africa were involved in some work that necessitated the visibility of result on Scopus. It is expected that, the provision of adequate resources like ICT facilities and infrastructure, as well as a conducive working environment for researchers, could facilitate significant research in this area. The study found out that most of the publications harvested were communicated through research articles, followed by conference papers, book chapters and editorial papers. The reason could be because most of the scholars/academics and medical practitioners would like to share their knowledge irrespective of the platform. Since HIs is a topical issue, most of research findings are likely to appear in research articles, conference papers and reviews. Importantly, since HIs is associated with medical practices, this could motivate individuals to be actively involved in writing research papers and promote scholarship and knowledge sharing. It was revealed that the Tomlinson, Hay, Farzadfar, Wools-Kaloustian, Lopez, Murray, Tierney and Yonemoto (19 publications) were the most prolific writers between 1987 and 2018. It can be noted that most of the authors were from renowned institutions of learning in Africa. Most of them have collaborated with institutions abroad; hence, the high volume of papers. The HIs papers were mostly on the subjects of medicine, computer science, social sciences, biochemistry, engineering, the health profession, immunology, environmental science and business management. The reason for this could be attributed to the fact that most of these subject areas are related to the health profession and computer science. The study indicates that *Plos One, Lancet, the International Journal of Medical Informatics, South African Medical Journal, BMC Public Health, ACM International Conference Proceeding Series, BMC Health Services Research, Informatics and Telecommunication Engineering* and *BMC Medical Informatics and Decision making* were the top journals, with high impact value that publishes research papers in HIs in Africa. The papers were mostly from South Africa, followed by Kenya,

Nigeria, Ghana Uganda, Tanzania, Cameroon, Ethiopia, Malawi, Rwanda and Zambia. Unfortunately, countries like Lesotho, Niger, Liberia, Madagascar, Djibouti, Equatorial Guinea and Chad did not perform to expectation, possibly due to inadequate funding and infrastructural facilities. As to why countries like South Africa**,** Kenya, Nigeria, Ghana, Uganda, Tanzania, Cameroon, Ethiopia, Malawi, Rwanda and Zambia perform better, the author postulates that this can be due to support from their respective governments and other related institutions like South African Medical Council, United States Agency for International Development, Bill and Melinda Gates Foundation, National Institute of Allergy and Infectious Diseases, National Research Foundation, Well come Trust, National Institute of Mental Health, Foundation for the National Institute of Health and Fogarty International Centre. Therefore, it is imperative to support organisations that advance research and development in every economy.

8. Conclusion

The study established that there is no uniformity in the results obtained in the publication on Scopus regarding HIs in Africa. Broad data and knowledge of health and medical practices are significant in the present-day information and knowledge economy. These are used to transform the evolving and growing nature of work in recent times. Although, a paucity of research in HIs, shows that researchers need to strategize on how to have progressive in-depth research practices. The outcome of mapping such publication patterns in a specific field was to analysis how scholars/academic research work contributes to systematic policy and research organisation. This was based on inclusivity in education, where deepened knowledge of researchers/scholars and medical practitioners are shared. It is believed that this study will add value to existing literature in the areas of HIs and strengthen scholarly communication and knowledge sharing in the HIs field. The visibility of research output over these years, 1987 to 2018, could assist academics/scholars and medical practitioners in the development of knowledge management strategies and the optimal use of databases and other institutional repository that house research output in HIs. The publication analysis could be used for appropriate strategic planning and decision making in medical practices based on the numbers of data harvested and required by practitioners on daily basis, to enhance their service delivery. The data and information harvested from different databases could also support local science discovery and institutional growth in Africa, considering the paucity of databases that houses data and information in organisations.

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Innovation And Knowledge Flows In Healthcare Ecosystems: The Portuguese Case

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Abstract: Innovation has come a long way since the times it was defined just as a new idea. Nowadays, innovation activities comprise a lot more, from new products and/or services to improvements in organisational business models. The healthcare sector is no exception. This leads public authorities to increase their investment in innovation, research and development in the healthcare sector. The rising of internal and external collaborations between hospitals and other parties calls for a specific analysis on how the healthcare innovation environments behave and how knowledge flows within them are managed. This study, through the lens of the ecosystem theory, aims to study how a healthcare innovation ecosystem can be activated and knowledge flows are managed to ensure that all the parties are benefited. For that purpose, it presents a case study based on a set of three meetings of Portuguese stakeholders inserted in innovation healthcare ecosystems. With this work it was possible to observe that the healthcare innovation ecosystem can be analysed from different perspectives. The interaction with the different stakeholders allowed to identify possible partners to be involved in innovation activities (e.g.: hospitals, universities, research centres, start-ups). This paper suggests possible roles for the different parties along the innovation funnel as well as what they can do in each phase. Using a case study approach, it is possible to compare different contexts and identify best practices on the management of healthcare innovation ecosystems. Also, it becomes evident the need for more effective knowledge management to ensure that hospitals and the other parties meet their goals and play a relevant role in the ecosystem. Although this paper provides guidelines for action, it lacks implementation of the suggestions in a specific context. As such, this paper aims to serve as a basis for future research on the study of hospitals' innovation ecosystems and underlying knowledge flows, in different contexts to achieve best practices for its effective management.

Keywords: healthcare innovation ecosystem; ecosystem theory; knowledge flows; knowledge transfer; stakeholders; hospitals

1. Introduction

The ability to innovate is often considered a key factor to achieve sustained growth, especially in an ever-increasingly ageing society that values wellbeing and health (Tolstykh, Gamidullaeva and Shmeleva, 2020). This leads public authorities to increase their investment in innovation, research and development in the healthcare sector, calling for a specific analysis on how the healthcare innovation environments behave and how knowledge flows within them are managed. Despite the importance of the theme, and although the subject of innovation ecosystems and its underlying flow of knowledge has been thoroughly studied in other contexts, very few of these studies address the specific case of healthcare, namely hospitals.

Nowadays, hospitals need to innovate not only internally (through the offering of new services, for example), but also externally, through collaborations with other organisations in the development of new solutions. As a result, the analysis of innovation ecosystems has benefited from extensive literature. The advantage of using the ecosystem approach relies on the fact that it considers the complexity of the business network established among a large number of actors and the interdependencies among them (Adner, 2017; Cavallo, Ghezzi and Balocco, 2018), .

The aim of this study is to analyse how it is possible to activate innovation and knowledge flows in healthcare ecosystems and ensure that all the participants benefit from its results, through a case study based on a group of Portuguese stakeholders. Moreover, this work aims to elaborate a set of best practices for the different stakeholders of the healthcare ecosystem that can promote innovation and knowledge flows among the entities. These guidelines relate to the different stages of the innovation process so that stakeholders can identify what to do along the process. Moreover, we would like to thank the 26 participants in this study, for their opinions and involvement.

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The paper is structured as follows: first, an introduction to the paper subject, followed by the methodology applied. Thirdly, the theoretical background. After, the results are presented, followed by its discussion, implications and limitations and conclusions.

2. Theoretical background

2.1 Innovation and knowledge flows in the healthcare sector

Innovation can be defined from various points of view, leading to the development of different types of innovation process models (Žižlavský, 2013; OECD/Eurostat, 2018). For this study, innovation is defined as the ideation and/or implementation of a new or improved product/service, process or business model (Dias and Escoval, 2014; Kelly and Young, 2017).

Depending on their goals, organisations must decide how they intend to innovate, using closed or open innovation (Chesbrough, 2012). This means that firms can choose between following an approach where they must generate ideas, develop and market them on their own, or an approach where they can use external ideas and even resources to maximize their knowledge (Bianchi *et al.*, 2011; Adner, 2017).

Nowadays, open innovation is often associated with the concept of globalisation and the development of new and innovative solutions in the organisations (Bogers, Chesbrough and Moedas, 2018). Using this approach, managers must decide between an inbound or an outbound open innovation strategy. It means that an organisation can choose to open the innovation process to knowledge exploration, or opening the innovation process to knowledge exploitation (Lichtenthaler, 2011). In both cases, there is a need to develop relationships with external parties (Bianchi *et al.*, 2011; Ribeiro and Nagano, 2018).

According to literature, hospitals appear to choose more open innovation approaches to deal with today's challenges (e.g. ageing people, need for more personalised treatment) (Secundo *et al.*, 2019; Peter *et al.*, 2020). Nevertheless, healthcare professionals (mainly doctors and nurses) do not always welcome external knowledge. This happens due to a common misunderstanding of the innovation processes' goals, which can lead to the boycott of innovation activities in the organisation (Hellström *et al.*, 2015; Carlucci, Mura and Schiuma, 2020).

To improve the current paradigm, hospitals managers need to open their institutions and collaborate with other parties to achieve better innovation results (Dias and Escoval, 2013, 2014; Secundo *et al.*, 2019). However, when establishing collaborations with other parties, tensions in the system can emerge due to a misalignment of the interests of the participants (Lantos and Simon, 2018).

Since it has been argued that the economics of the 21st century are mainly characterised by knowledge, information and innovation, the knowledge and technology transfers are not only important within the organisation, but also between different organisations. (Žižlavský, 2013). The way these transfers are managed will strategically impact both sides of a collaborative partnership and the operationalisation of the innovation ecosystem (Shaw, 1988; ISO, 2019).

As such, hospitals need to manage not only internal knowledge but also the knowledge emerging from the networks created due to the "interaction and co-creation" across hospitals and other stakeholders in the system (Bianchi, et al., 2011; Lichtenthaler, 2011; Sieg, Wallin and von Krogh, 2019). Due to being a process driven service, the healthcare sector offers the opportunity to implement practices for the management of knowledge flows to improve existing processes (Bordoloi and Islam, 2012). However, due to the number and proximity among stakeholders involved in an innovation process the management of knowledge is challenging, since the different parties are known for playing different roles on an innovation ecosystem during the value creation process (Bordoloi and Islam, 2012; Lambooij and Hummel, 2013; Tranekjer, 2017; Scaringella and Radziwon, 2019).

The establishment of a sustainable ecosystem between different players and partners can lead to the creation of an unique environment, allowing a better business performance for all the involved parties (Järvi, Almpanopoulou and Ritala, 2018) acting as a key driver for the innovation process (Suominen, Seppänen and Dedehayir, 2019). Still, to achieve successful goals, the interested parties must understand what each can do in the process and anticipate interdependencies that arise from the process (Wilson and Doz, 2012; Thune and Mina, 2016). As important as identifying the network that can be formed during the innovation process, is the

identification of partners and the correct management of the ecosystem through the identification of the ties that can be established and the knowledge flows that can be enacted (see Figure 1). Since knowledge management has the power to improve processes in the healthcare sector, the implementation of a mechanism to manage it is considered an essential tool to achieve efficiency in all areas (Bordoloi and Islam, 2012; Massaro, Dumay and Garlatti, 2015).

Hospital managers must be aware that their institutions work in an unique context in which stakeholders are vast and act different from the private sector (Riege and Lindsay, 2006; Massaro, Dumay and Garlatti, 2015). So, the management of knowledge flows must consider elements related to people, processes and technology (Edwards, 2011; Ford and Yoho, 2020). Moreover, the implementation of knowledge management practices can help to improve efficiency in all areas of the sector (Massaro, Dumay and Garlatti, 2015; Shabbir and Gardezi, 2020).

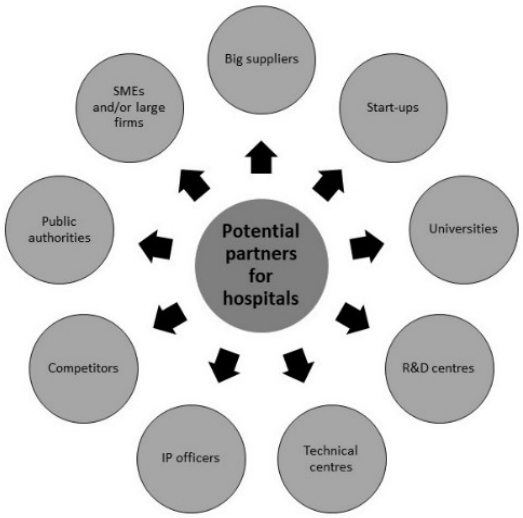

Figure 1: Suggested actors in the healthcare ecosystem. Adapted from ISO 56003:2019

2.2 Ecosystem Theory

In literature it is mentioned the need to study in more detail the healthcare ecosystem in what relates to innovation creation and its underlying knowledge flows (Secundo *et al.*, 2019). This concept first emerged from the field of biology and refers to a complex system, hosting a number of entities and elements (Adner, 2017) and continued to be improved until it reached the management literature in mid 1990s (Cavallo, Ghezzi and Balocco, 2018; Scaringella and Radziwon, 2019).

Considering the necessities of the current business world, the innovation ecosystems are gaining importance as a lever to foster innovation in organisations (Secundo *et al.*, 2019; Suominen, Seppänen and Dedehayir, 2019; Arenal *et al.*, 2020). As mentioned previously, hospitals and healthcare institutions need to reposition themselves in the way they interact with society. To support this process, the concept of innovation ecosystems can play a guiding role. Since it includes a larger variety of actors, and the knowledge and the technology transferred among them resides in the interactions among the members, the ecosystem theory can help to implement new approaches (Secundo *et al.*, 2019). The effective management of knowledge flows ensures the safety of sharing while guaranteeing that the “unresolved questions are not missed” (Maženytė and Petraitė, 2020).

Although theoretical concepts on healthcare innovation ecosystems are formally developed, very few case studies have been found in literature (while searching TOPIC “healthcare innovation ecosystem” or “healthcare knowledge ecosystem” and TOPIC “case study”). The works found are listed in Table 1, as it may help future research.

Table 1: Papers found using TOPIC "healthcare innovation ecosystem" or "healthcare knowledge ecosystem" and TOPIC "case study"

Year	Title	Author(s)
2020	Opening new pathways for innovation in healthcare	Pavani, C.; Plonski, G.A.
2019	Responsible for responsibility? A study of e-health start-ups	Oftedal, E.M.; Foss, L.; Iakovleva, T.
2018	Understanding Convergent Innovation in Healthcare Technologies: Relational Models for Nascent Ecosystems	Phillips, M. A.
2018	Intellectual property evolution and innovation ecosystem as effective tools in strengthening Indian healthcare sector	Dixit, T.; Srivastava, S.; Sahu, S.; Selvamurthy, W.
2018	Introducing a governance framework for the innovation ecosystems. The case of the public healthcare innovation ecosystem in the Lombardy Region	Barbarossa, M.
2018	A methodology for case study research to analyse innovation platforms in South African healthcare sector	Dondofema, R. A.; Grobbelaar, S.
2017	Development of an Interoperable Exchange, Aggregation and Analysis Platform for Health and Environmental Data	Alakraa, M.
2017	Orchestration roles to facilitate networked innovation in a healthcare ecosystem	Pikkarainen, M.; Ervasti, M.
2017	The roles of Innovation Network Orchestrators in Healthcare Ecosystem	Pikkarainen, M.; Ervasti, M.
2017	Networked commercialisation of medical innovation – personalised medicine	Korhonen, R.
2016	Governance of Digital Innovation in Regional Healthcare Innovation Ecosystem	Pistorio, A.; Gastaldi, L.; Locatelli, P.
2016	Digital health innovation ecosystems: From systematic literature review to conceptual framework	Iyawa, G. E.; Herselman, M.; Botha, A.
2015	Personal health systems technologies: critical issues in service innovation and diffusion	Schartinger, D.; Miles, I.; Saritas, O.
2013	Accelerating digital health innovation: Analysing opportunities in the healthcare innovation ecosystem	Cohen, E.
2012	Workforce for innovative regulatory science	Olson, S.; Claiborne, A. B.
2011	Making the most of public services	Levy, C.

As such, this article aims to contribute to this gap in knowledge by bringing together the elements of the Portuguese healthcare ecosystem, identify its internal strengths and weaknesses and analyse its external opportunities and threats. So, the following research question emerged: *How it is possible to activate innovation and knowledge flows in healthcare ecosystems and ensure that all the participants benefit from its results?*

3. Methods

Considering the Portuguese healthcare sector, there is a clear lack of innovation initiatives that connect hospitals with the academia, the industry, the government and the civil society (Dias and Escoval, 2014; Moreira, Gherman and Sousa, 2017).

To validate this perception, a literature review was carried focused on innovation in the healthcare sector and/or ecosystem and the underlying knowledge flows, as well as the role of stakeholders in the ecosystem and a brief review of the theories supporting the study.

To help answering the research question, elements from organisations that belong to the healthcare ecosystem (such as hospitals, universities/research centres, pharmaceutical companies, small and medium enterprises (SMEs), start-ups, public authorities and patients' associations) were selected to participate in meetings through three rounds This technique allows to select individuals that have experience on a certain subject, according to a set of criteria. In this case, each individual had to be member of an entity that is included in the Portuguese healthcare ecosystem and with experience on the area. Moreover, through the social interactions of the group, the results obtained tend to be better than individuals face-to-face interviews (Rabiee, 2004)

With this qualitative technique, the individuals were able to provide their ideas and opinions regarding the management of innovation in healthcare ecosystems in Portugal. The work group was composed by 26 individuals from different sectors. The inclusion of elements from diverse organisations allows to have a sample

composed by organisations from the four helices of the quadruple helix model, namely society, government, academia and industry (Carayannis and Campbell, 2010; Hasche, Höglund and Linton, 2019).

Tables 2 and 3 show the sample characteristics based on gender and the function of each participant in the organisation. Table 4 characterizes the participating entities by framing them into the Quadruple Helix Model.

Table 2: Sample characteristics based on gender

Gender	Masculine	Feminine
Percentage	61,5%	38,5%
Number	16	10
Total	**26**	

Table 3: Sample characteristics based on function at the organisation

Function	Number
Professor	4
Manager	11
Director	4
Board Member	3
Consultant	2
Researcher	2
Total of participants	**26**

Table 4: Sample characteristics of the participating entities based on the Quadruple Helix Model

Quadruple Helix Entities	Number
Society	1
Government	7
Academia	7
Industry	5
Total of participating entities	**20**

The meetings were guided by information from the literature and personal knowledge of the performance of the healthcare innovation ecosystem in Portugal.

The first meeting focused on presenting the national context, thus identifying the strengths and weaknesses of the health innovation system and identifying best practices.

The second meeting complemented and validated the findings of the first meeting and made an initial discussion of the best practices identified.

The third meeting finished the SWOT/TOWS matrix and the best practices identification.

From the discussion, a set of strengths and weaknesses of the innovation ecosystem was identified as well as a set of opportunities and threats in the environment surrounding the ecosystem, that lead to the development of a TOWS matrix (Weihrich, 1982). The results of this matrix enabled the identification of lines of action that not only address the research question, but also lead to medium-term vision of how the healthcare ecosystem can be managed so that innovation can be achieved, and knowledge can flow among the members of the ecosystem.

4. Results and discussion

First, there was the need to identify the elements involved in the innovation process, considering the well-known "innovation funnel" process that describes how ideas are generated, turned into concepts, manufactured and them commercialised.

For this study, the state-owned hospital innovation ecosystem was the one considered. However, other healthcare innovation ecosystems can be identified such as the case of private hospitals and nursing homes, among others.

Before providing the actions that each actor can play along the process, it must be defined the position of hospitals in it. Traditionally, state-owned hospitals are considered secondary actors in the development of new solutions, as suggested in Figure 2. This means that they enter in the process when contacted by other players and only perform the functions which are determined by others (Secundo *et al.*, 2019). The results show evidence from the Portuguese case.

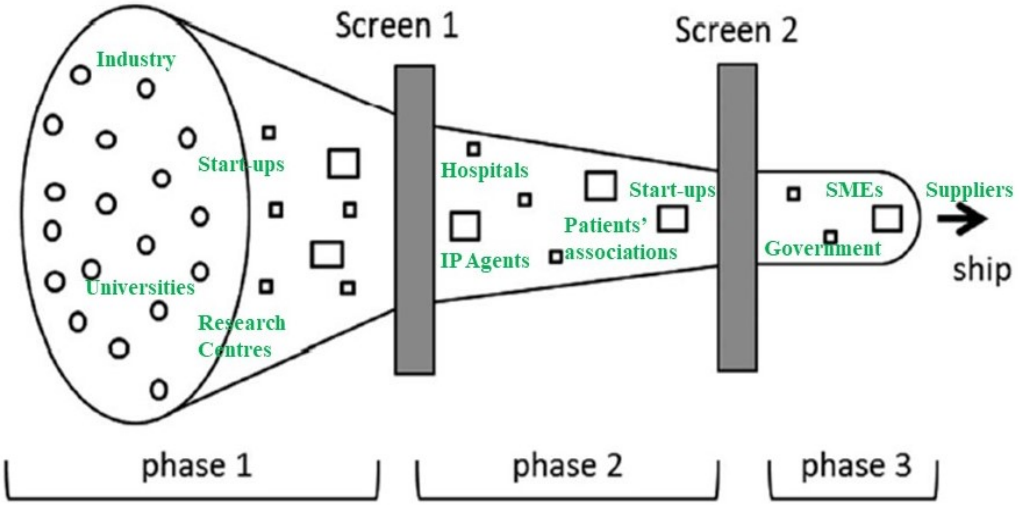

Figure 2: Suggested traditional position from hospitals in the healthcare innovation ecosystem. Adapted from (Bagno, Salerno and da Silva, 2017)

The Portuguese healthcare sector has a public portal that highlights the importance of innovation in healthcare. However, a health innovation strategy does not exist. These leads, in one hand, to the non-involvement of patients in the assessment of innovative solutions and, on the other hand, to SMEs and start-ups not being able to focus on the development of products that can be scaled up by the ecosystem.

Also, the individuals identified that the knowledge creation process is focused on the academia with few contacts with the healthcare institutions. The healthcare sector in Portugal is mainly composed by state-owned hospitals, which do not have a competitive nature and tend to ignore the need to incorporate innovation and the underlying knowledge when adopting new technologies. Therefore, as identified in the literature, technological innovation adoption is frequently prevented by the lack of partnerships between healthcare institutions and other parties in the ecosystem (Tidd and Bessant, 2009). One reason for this is that hospital managers have no incentive to hire innovation managers that can structure these relationships.

Although it seems that the healthcare sector in Portugal is facing serious difficulties, the people involved in this study identified some opportunities to improve it. Portugal can learn from other European countries who are leaders in innovation in the sector (e.g., see Øvretveit *et al.*, 2012). It exists the opportunity to develop and incorporate new approaches that can lead to new and innovative business models, in which hospitals play a more central and decisive role, as identified in the literature (Dias and Escoval, 2012). Also, even though the EU data policy is restrictive, Portugal has the capacity to manage the existing data from patients, hospitals and other stakeholders through the development and implementation of new technological services. Therefore, a need for the introduction of new information systems that allow data standardisation, without compromising individual identification emerges. This can allow to define behavioural patterns and provide a better service, through the efficient management of knowledge flows (Laihonen, 2015).

The main contribution of this paper is the analysis of the results through a TOWS matrix. This technique allows to identify actions to leverage strengths and seize opportunities (SO); assess how threats can be accessed by the strengths (ST); understand which opportunities are not explored due to weaknesses (WO) and identify which threats are impacted seriously by the weaknesses (WT), as it can be seen in detail in Appendix 1.

Such technique helped to draw a set of guidelines to improve innovation and knowledge flow in the healthcare ecosystem while identifying actions that each player can perform in the healthcare ecosystem were identified,

allowing to redefine the role of hospitals in it. These guidelines (Tables 5, 6 and 7) were defined considering each phase of the innovation process. As a result, the innovation funnel was redrawn in Figure 3, considering a more active role of hospitals in the ecosystem.

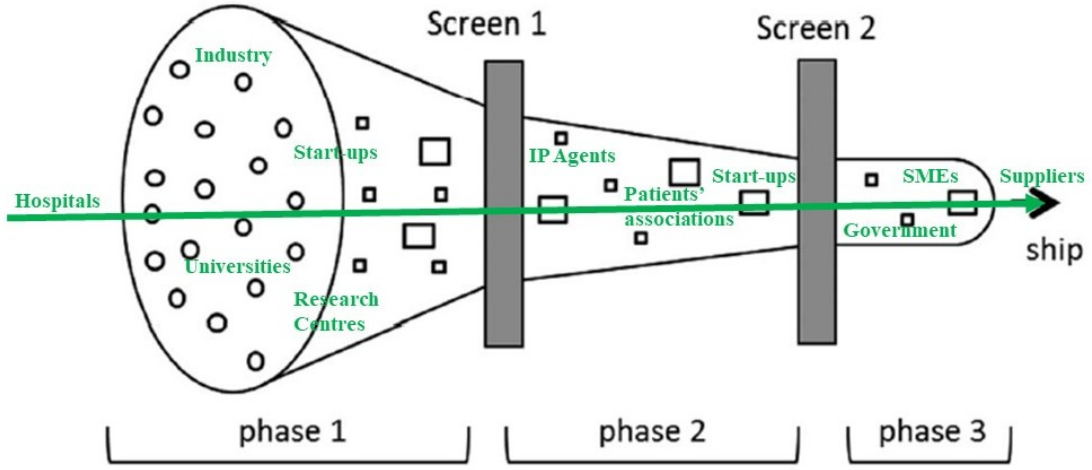

Figure 3: Suggested new hospital position in the healthcare innovation ecosystem. Adapted from (Bagno, Salerno and da Silva, 2017)

The first stage of the innovation process (ideation) refers to the product/service/process idea generation and selection, considering the viability and importance for the organisation. The aim of this stage is to collect as many ideas as possible to increase the possibilities of improvement by the organisation. Therefore, the goals of the parties involved as well as the responsibilities and the role each can play in the process must be well defined (Hakkarainen and Consulting, 2014; Bagno, Salerno and da Silva, 2017).

Table 5: Actors and suggested actions in the first phase (ideation) of the innovation process

Actor of the ecosystem	Actions suggested
Universities	Encourage the participation of the students in innovation projects in the healthcare sector; Inclusion of management disciplines in the healthcare courses to enable commercialisation of research results; Promote the integration of medicine students in projects from other areas such as management to empower them with other skills; Promote dynamics of contact with different entities of the healthcare innovation ecosystem to study how knowledge is managed; Promote training in entrepreneurship activities.
Research centres	Test and validate pilots and projects in the market; Make the results from projects and pilots available and accessible for companies that are willing to transform them into commercial products.
Start-ups	Define their role in the innovation process and operate according to the resources available (human, financial, engineering, etc); Promote the participation of elements from staff in conferences and other relevant events related to the development of innovative approaches in the healthcare sector to be updated; Hire knowledgeable people in the healthcare field to become relevant in the market and know how to operate in it.

Moving to the second stage (proof of concept), in this phase there is space to develop the concept, detailing the project and requirements for further development and implementation, according to defined criteria. The ideas must be matched according to the goals of the ecosystem, while choosing approaches to test the concept (Hakkarainen and Consulting, 2014; Bagno, Salerno and da Silva, 2017).

Table 6: Actors and actions suggested in the second stage (proof of concept) of the innovation process

Actor of the ecosystem	Actions suggested
Start-ups	Select the most suitable stakeholder for the project and enter networking and knowledge transfer agreements with other stakeholders; Identify funding opportunities that enable the creation of marketable products.
Patients associations	Promote the participation of patients in clinical tests to assess the performance of innovative solutions; Promote the use of information systems in the healthcare sector by patients to express their needs and opinions; Promote the advantages for the patients that result from participating in the innovation ecosystem.
Intellectual Property (IP) Agents	Must be integrated in the innovation process since its beginning to guarantee that the objectives of the project do not duplicate existing results and that the intended results are properly protected; Must act as neutral parties, guaranteeing that each participant in the ecosystem is properly rewarded for its involvement and has a stake in the IP generated and receives adequate royalties from the commercialisation of IP.

The last phase of the innovation funnel refers to the manufacturing, distribution and sales, which consists in releasing the new product/service or implement a new process/business model (Hakkarainen and Consulting, 2014; Bagno, Salerno and da Silva, 2017).

Table 7: Actors and actions suggest in the third phase (manufacturing, distribution and sales) of the innovation process

Actors	Actions suggested
SMEs	Focus on proactively performing competitive assessments of the research and development results that show potential to be transformed into commercial products; Integrate consortia that links them with companies from other countries enabling learning processes and accessing new funding opportunities, exposing them to new markets; Perform proactively a risk-assessment analysis that highlights the main problems and difficulties that they may have during the fulfilment of the innovation process.
Suppliers (large companies)	Align business agenda with the main research themes addressed by research centres in the ecosystem; Promote the integration of different parties in the innovation process. For that, it is necessary to strike a balance from its participation in the ecosystem (i.e. benefiting from it while, at the same time, promoting the emergence of new players); Considering the emergence of new players, leverage the existing physical and financial infrastructure to guide promising research towards the marketplace
Public authorities/government	Fund the development of a platform where the stakeholders of a healthcare innovation ecosystem can establish long-term relationships with underlying support structures; Create a national healthcare innovation strategy through the disclosure of opportunities to develop innovate solutions (at a regional, national and European levels); Develop a new approach to reduce the bureaucratic processes and make the information publicly available and easy to access; Review the current funding model of healthcare institutions, considering a value-based healthcare strategy, which aims to increase the investment in research, development, and innovation,

Considering the continuous role of the hospitals in the process, the following key approaches were identified. Hospitals must try to define an innovation agenda that they can manage in the medium and long-term relationships, being able to quantify the benefits of participating in the ecosystem. Also, they should promote

the participation of patients and staff in innovation projects by providing more information and showing its benefits to the users, promoting data collection, analysis and treatment for knowledge creation.

Hiring innovation managers, to supervise innovation processes in the hospital and the surrounding ecosystem, can play a decisive part in enhancing the role and responsibilities of the hospital in the innovation process. The integration of a knowledge and technology manager in the institution is important to ensure that the parties are levelled and are communicating on a *peer to peer* basis.

Also, it is suggested that according to the resources available, hospitals must try to leverage their position in the innovation process while seeking to obtain a more active role that can benefit their participation in this type of projects.

As it can be seen, a significant number of stakeholders can be identified in the healthcare innovation ecosystem as well as actions that each can take, which implies an intensive change of knowledge. From these results, this paper suggests the creation of an online platform where participants in the healthcare sector can find stakeholders to develop innovative solutions – from consortia identification to market results, ensuring the adequate funding mechanisms and support activities necessary to achieve these results.

As such, there is the need to implement knowledge flows management practices, to ensure successful collaborations. However, the role of the stakeholder depends on the goals of the ecosystem, the goals of each participant and the resources each party is willing to provide. This validates the use of the ecosystem approach, since it considers a large number of actors and the tensions that can emerge from the collaborations established.

Answering the research question, the creation and development of the ecosystem is only possible and activated if the existing strengths can be properly leveraged. This can happen through the creation of an innovation platform that ignites, guide and support the relationships between stakeholders during the entire innovation process life cycle. Along the process, there is also the need to implement knowledge management practices, that are complex in the public sector (Massaro, Dumay and Garlatti, 2015). However, some effort must be made to ensure that these practices are implemented. Also, the need to manage knowledge needs to be communicated between all the parties involved in the ecosystem, so that knowledge can flow and improve the work developed in the network.

5. Conclusion

Innovation has come a long way since the times it was defined just as a new idea. Nowadays, innovation activities range from the development of new products and/or services to improvements in organisational business models. The healthcare sector is no exception. Innovation in this sector as being increasing over time and in the last years it has occupied a prominent place in the national and European agenda.

With this study it was possible to observe that the healthcare innovation ecosystem can be analysed from different perspectives. However, it is important to emphasize the role of the hospital in the process, to achieve better results and improve their innovative capabilities. Using a case study approach, it will be possible to compare different contexts and achieve best practices on the management of healthcare innovation ecosystems.

Also, the need for more effective knowledge management and technology practices is evident to ensure that hospitals and the other parties meet their goals and play their role in the ecosystem.

Finally, to answer to the research question, our perception is clear. It is only possible to activate innovation and knowledge flows in healthcare ecosystems and ensure that all the participants benefit from its results and for that to happen, it is necessary to have a catalyser (an entity or individual) that is responsible for finding the best partnership opportunities to innovate.

5.1 Implications

This work has strived to understand the necessary conditions for the creation of such an ecosystem, identifying the current status quo, its strengths and weaknesses, as well as external opportunities and threats.

Based on the existing characteristics, a road map proposal was defined that can contribute to the emergence of a healthcare innovation ecosystem from which all parties can benefit and pursue, in a more rational and practical approach their research and business objectives. Also, this study identifies the pertinence of developing an online platform to manage the innovation ecosystem and its stakeholders, which currently does not exist in the country.

5.2 Limitations and future research suggestions

Although the paper provided guidelines for action, there is the lack of implementation of the suggestions in a specific context. So, this paper aims to serve as a basis for future research on the study of hospitals' innovation ecosystems and knowledge flows among the involved parties.

Moreover, the development of case studies regarding the creation, development and maintenance of hospital innovation ecosystems in different contexts could help to achieve best practices for its effective management. Also, the enrichment of the literature, with the analysis of different regions could help to foster innovation in countries with low levels of innovation in the healthcare sector, since they could learn from others and among each other.

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Appendix 1 - TOWS Analysis

	O01. Introduction of informatic software in the healthcare services	**O02. Management of clinical data among stakeholders**	**O03. New business models**	**O04. Learn from other countries**	**O05. Manage clinical data to negotiate with pharmaceutics and assess medical equipment in a large scale**
S01. Public platform that gives importance to innovation in the healthcare sector	The connection between data from the system and the platform could help to identify innovation opportunities more easily according to the patterns	Connecting the data to identify hospitals where innovation is more rapidly growing	Identification of innovative opportunities to identify how hospitals can operate at a local level based on their experience	Learn from others of how they assess innovation opportunities	Data can help to benchmark partnerships, evaluating them periodically and create incentive mechanisms in the medium and long-term
S02. Structured and integrated information about what is being done in the healthcare sector, available for all users	Promote sharing of anonymous data from patients that can help to identify opportunities to develop innovative solutions	Help to identify opportunities for the implementation of innovative solutions	N/A	In learning from other countries, the data can help to identify which initiatives can be developed and which to leave	Data from patients can help to identify possible partnerships with pharmaceutical industry in the development of innovative solutions
S03. Large amount of organisation information available that allows to compare and assess hospitals´ performance	Identify hospitals that are more suitable for the treatment of a patient and share information between hospitals to achieve best practices	The comparison of the information from organisations and the SPMS	Promote the use of data	Portugal can learn from other countries how they collect information from hospitals and even enter in contact with those hospitals to achieve best practices	Promote partnerships in the development of innovative solutions.
S04. Healthcare universities courses that implemented entrepreneurship disciplines in their curricular plan	The use of the data can help to test pilots.	In assessing institutions there is the opportunity to identify places where to implement, test and validate telemedicine projects	As telemedicine will change the business model, managers need to be aware of how it can impact the performance of the institution	Portugal can learn from other countries that are more advanced in the practice of telemedicine and achieve best practices at a European level	The availability of data from patients, even anonymous, can help to identify opportunities for the development of telemedicine

	Introduction of informatic software in the healthcare services	**O02. Management of clinical data among stakeholders**	**O03. New business models**	**O04. Learn from other countries**	**O05. Manage clinical data to negotiate with pharmaceutics and assess medical equipment in a large scale**
W01. Technological innovation adoption is presented by the lack of partnerships in the ecosystem	The access to this data can help to discover innovation opportunities	The identification of how institutions are performing can help attract companies to collaborate with.	A business model composed by all the parties and their role must be defined	Other countries are fostering the connection between different parties surrounding the health ecosystem (for example, in November 2019, EHMA hosted a conference with this purpose)	Achievement of innovative solutions that are really in need in the market. Moreover, the involvement of patients as an active party can help to better assess innovations
W02. Lack of funding to hire hospital innovation managers	N/A	The identification of how institutions are performing can help to understand why they do not hire innovation managers	When developing new business models always considering the necessity of hiring an innovation manager	Innovation managers are frequently used in other countries, such as Sweden. Portugal needs to understand and learn how others are doing it	N/A
W03. Lack of a national healthcare innovation strategy	The data can help to identify if there is or there is not the need for this strategy	The data can help to identify if there is or there is not the need for this strategy	Promote a value chain composed by different stakeholders to transfer knowledge and technology to achieve innovative solutions	Portugal needs to analyse other countries' innovation strategy and learn how to develop and implement one	The involvement of the patients, that are part of the ecosystem and the principal "customer" can help to identify opportunities for the development of the strategy
W04. The SMEs and start-ups not focused on the development of products that can be scaled up	Data can help firm achieve other innovation opportunities beside service	Data can help companies identify hospitals to collaborate with in the development of innovative solutions.	Englobe companies in R&D phases throughout the entire business model	Portugal needs to learn from other countries how they are managing the introduction of home-companies in other phases besides service delivering	The data from patients can help companies to identify market opportunities
W05. Significant gap between R&D and market	Data can help to achieve innovative solutions that are in need in the market	Hospitals that are more suitable for a certain innovation can be identified as academic hospitals in which tests and pilots can be carried out and act as example for	Need to adapt the business model from hospitals as centres of testing	Portugal can learn from other countries in the assessment and selection of which innovations are in need and how to implement it	With the data from patients, innovations that are really in need can be identified. A more effective implementation can be achieved because it considers the human factor.

	Introduction of informatic software in the healthcare services	**O02. Management of clinical data among stakeholders**	**O03. New business models**	**O04. Learn from other countries**	**O05. Manage clinical data to negotiate with pharmaceutics and assess medical equipment in a large scale**
		others to do the same			
W06. Knowledge creation process is focused on the academia with few contacts with the healthcare institutions	Data can help to achieve innovative solutions that are in need in the market	Hospitals can help researchers to connect more with companies establishing meetings between the parties to develop solutions in need to improve the hospital performance	Consider the role of the parties in the business model and the approach that can guide the process	Need for researchers to analyse case studies from other countries and even contact those researchers to see how the contact is established and what are the benefits	In developing case studies with patients and accessing data from them, researchers can understand how they can impact the real world with the contact established with companies in the development of innovative solutions
W07. Patients are not involved in the assessment of innovative solutions	The correct management of data can allow to select groups of patients to assess certain technologies depending on the health problem	Groups of patients in the hospitals can be identified as possible sources to be involved in the innovation process. Managers and those responsible for the innovation process need to be open for the patients' opinions	Involve the patients as a new approach for innovation as a value-based healthcare approach	Patients should be aware of international case studies and how the patients can act along the innovation process to understand the importance of their role.	Data from patients can help identify groups of people that are available to participate in the innovation process according to the necessities of the innovative solution and the patient

	T02. Lack of capacity for start-ups to access funding opportunities to scale up	**T03. The new EU data policy obligates to a restrictive use of data**	**T04. Lack of time to market due to reduced funding for SMEs and start-ups**	**T05. The human is frequently ignored when considering the adoption of new technologies**	**T07. The healthcare sector in Portugal is mainly composed by public hospitals and the Ministry of Health is a direct competitor with the private healthcare technological organisations**
S01. Public platform that gives importance to innovation in the healthcare sector	Considering the data from the platform there is the opportunity to identify where funding can be provided	The availability of the information can be used by organisations to identify health institutions to collaborate with	Considering the data from the platform there is the opportunity to identify where funding can be provided	N/A	This may lead the institution to not have the autonomy to choose who to collaborate with
S02. Structured and integrated information about what is being done in the healthcare sector, available for all users	Considering the data from the platform there is the opportunity to identify where funding can be provided	The availability of the information must be analysed according to the new norms	Considering the data from the platform there is the opportunity to identify where funding can be provided	The users should be involved and be able to give their opinion since they are the human factor that needs to be considered	This may lead the institution to not have the autonomy to choose who to collaborate with
S03. Large amount of organisation information available that allows to compare and assess hospitals´performance	Considering the data from the platform there is the opportunity to identify where funding can be provided	The availability of the information must be analysed according to the new norms	Considering the data from the platform there is the opportunity to identify where funding can be provided	Consider not only the organisations' information but also the involvement of patients in the process to consider a value-based healthcare approach	This may lead the institution to not have the autonomy to choose who to collaborate with
S04. Healthcare universities courses that implemented entrepreneurship disciplines in their curricular plan	Opportunity to develop programmes were students analyse those start-ups and develop projects of what can be done to improve their performance	N/A	N/A	Foster the development of case studies of how innovation processes occur in healthcare institutions	This may lead the institution to not have the autonomy to choose who to collaborate with

	T02. Lack of capacity for start-ups to access funding opportunities to scale up	**T03. The new EU data policy obligates to a restrictive use of data**	**T04. Lack of time to market due to reduced funding for SMEs and start-ups**	**T05. The human is frequently ignored when considering the adoption of new technologies**	**T07. The healthcare sector in Portugal is mainly composed by public hospitals and the Ministry of Health is a direct competitor with the private healthcare technological organisations**
W01. Technological innovation adoption is presented by the lack of partnerships in the ecosystem	It is necessary to involve all stakeholders	Considering the knowledge transfer involved in collaborations, the correct use of data must be assured	If companies want to incorporate high levels of knowledge in their exportable products, networks can provide the easier access to know-how, methods and techniques.	Due to the reduced importance given to the human factor also the role of patients in the ecosystem is not clearly defined	Due to the power of the Minister, this only will reduce when hospitals start to gain more autonomy in choosing who to collaborate with
W02. Lack of funding to hire hospital innovation managers	N/A	N/A	The reduction of funding made it difficult to hire such expertise which affects the performance of the innovation in the hospital, because managers are worried with aspects "more important" than innovation	N/A	Due to the power of the Minister, this only will reduce when hospitals start to gain more autonomy in choosing who to collaborate with
W03. Lack of a national healthcare innovation strategy	Define an healthcare innovation strategy involving start-ups	This strategy, must consider how to collect and manage data from hospitals, companies, patients, etc	N/A	Patients and group of representatives of patients need to be heard	The strategy must be developed and hospitals managers need to enhance the fact that hospitals need more autonomy
W04. The SMEs and start-ups not focused on the development of products that can be scaled up	Interconnect companies within networks, in order to scale up businesses	The new EU norms make it clear that companies must provide public reports of their activities.	Reducing budgets of providers of health and research may reduce companies' incentives to maintain (or create new) connections with enterprises dedicated to the same area of activities	This proves that the human factor is neglected most of the time	Due to the power of the Minister, this only will reduce when hospitals start to gain more autonomy in choosing who to collaborate with

	T02. Lack of capacity for start-ups to access funding opportunities to scale up	**T03. The new EU data policy obligates to a restrictive use of data**	**T04. Lack of time to market due to reduced funding for SMEs and start-ups**	**T05. The human is frequently ignored when considering the adoption of new technologies**	**T07. The healthcare sector in Portugal is mainly composed by public hospitals and the Ministry of Health is a direct competitor with the private healthcare technological organisations**
W05. Significant gap between R&D and market	Start-ups should search for new funding opportunities	The measures introduced by the EU can affect the implementation of innovative solutions due more bureaucratic processes to assure that the information is correctly used	Reducing budgets of providers of health and research may reduce companies' incentives to maintain (or create new) connections with enterprises dedicated to the same area of activities	Understand more deeply the population to facilitate the development and introduction of new technologies	Due to the power of the Minister, this only will reduce when hospitals start to gain more autonomy in choosing who to collaborate with
W06. Knowledge creation process is focused on the academia with few contacts with the healthcare institutions	Start-ups can be used as places where to test researchers' ideas and considering the dimension of the university, the start-up can make a deal to use it in their favour through for example promotion of collaboration between the parties	The knowledge transferred between the parties must be managed according to the EU norms which can act as a disadvantage due to the bureaucratic processes	The reduction of funding made it difficult to develop incentive programmes	Development of case studies.	Case studies can help to proof this as well as identifying solutions for this problem (e.g. a reformulation of the system)
W07. Patients are not involved in the assessment of innovative solutions	Need for more funding and recognition of start-ups as safe places	The involvement of the patients must assure that the patient authorises the use of the information	The reduction of funding made it difficult to develop incentive programmes	Understand more deeply the population to facilitate the development and introduction of new technologies	Patients are not seen as part of the ecosystem by the government. There is the need to include the people

Assessing KM Capabilities in two African Healthcare Organizations: Case Study

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Abstract: This study aims to better understand the process for the development of organizational capabilities specific to knowledge management (KMC) in the context of healthcare organizations. This process lies within the framework of apprenticeship training that promotes a process for organizational training and knowledge acquisition that can be spread over time and at different levels of intellectual development. Healthcare organizations are among those organizations that still struggle to adequately use the existing knowledge of their employees, due to the lack of good knowledge management. Although most of them are modernizing with computers and new technologies, is there effective knowledge management of employees, and what is their level of KMC? Besides, massive data and information is collected every day in health facilities, do they use it for effective decision-making and to strengthen their knowledge? This paper presents an analysis and develops a model that presents five levels of intellectual progress using the KMC maturity model as a development model to assess the KMC levels of two hospital organizations in the Democratic Republic of Congo which is one of the countries of sub-Saharan Africa. Our model includes three dimensions: 1. knowledge infrastructures in knowledge management; 2) knowledge management process; 3) knowledge management competency. These three dimensions aim to seek improvements or to develop the KMC of our studied health facilities. Finally, we wish to emphasize that the conclusions of this study are not representative of quantitative research but rather qualitative research that aims to comprehend the phenomenon of the knowledge management capabilities (KMC) in a context through this case study. From a practical point of view, this article provides for the identification of factors that influence the nature and effectiveness of the use of KMC in healthcare facilities. Also, promote the use of the KMC maturity model as a model for evaluating health organizations aimed at helping the health sector to set new standards for information flow and to manage their KM well. This paper presents an analysis and develops a model of the factors that influence unlearning focused on the healthcare industry. It is comprised of three constituent components: 1) a framework characterizing the lens through which individuals view situations; 2) a framework for characterizing how individual habits change and 3) a framework for characterizing the manner in which emergent understandings are consolidated into existing knowledge and knowledge structures. This paper presents an analysis and develops a model of the factors that influence unlearning focused on the healthcare industry. It is comprised of three constituent components: 1) a framework characterizing the lens through which individuals view situations; 2) a framework for characterizing how individual habits change and 3) a framework for characterizing the manner in which emergent understandings are consolidated into existing knowledge and knowledge structures. This paper presents an analysis and develops a model of the factors that influence unlearning focused on the healthcare industry. It is comprised of three constituent components: 1) a framework characterizing the lens through which individuals view situations; 2) a framework for characterizing how individual habits change and 3) a framework for characterizing the manner in which emergent understandings are consolidated into existing knowledge and knowledge structures. This paper presents an analysis and develops a model of the factors that influence unlearning focused on the healthcare industry. It is comprised of three constituent components: 1) a framework characterizing the lens through which individuals view situations; 2) a framework for characterizing how individual habits change and 3) a framework for characterizing the manner in which emergent understandings are consolidated into existing knowledge and knowledge structures.

Keywords: Case study, knowledge management, organizational capabilities, intellectual development

1. Introduction

Most managers and decision-makers have taken note of the crucial role that good knowledge management can impart to their organizations. Because they are bombarded every day with information such as emails, vocal messages, faxes, reports, memos, etc. in such a repetitive fashion, they have found in knowledge management a solution to the massive input overload that they have been subjected to (Sharma, Wickramasinghe and Gupta, 2005). In effect, professionals spend most of their time searching for information they need on the Web, sending emails, making telephone calls, and examining reports both on computers and on paper (Sharma, Wickramasinghe and Gupta, 2005). The stated problem is again just as severe at the level of healthcare organizations that are preoccupied with good knowledge management to organize and to facilitate

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the conservation, circulation, and utilization of data, information, and medical knowledge as well as health administration. Furthermore, some studies (Pauker et al, 1976) prove that doctors use approximately two million pieces of information to manage their patients. Also, one-third of a doctor's time is spent on recording and combining information. Finally, one-third of the costs of health care providers are related directly to personal and professional communications (Hersch and Lunin, 1995).

Furthermore, today it is difficult and even inconceivable for a healthcare professional to properly conduct his practice without regularly upgrading his skills or exchanging information from within or outside his practice (Desouza, 2005). In effect, most healthcare organizations cannot adequately utilize the existing knowledge of their employees because of faulty documentation, a lack of sharing of expertise among employees, the turnover rate of personnel, and a lack of time and interest by employees themselves, etc (Chase, 1998). Besides, this problem is serious in African organizations in general and in particular in the healthcare organization of the Democratic Republic of Congo, as many of them have not yet implemented information technology and are using more handwriting data that leads to management and decision making not based on fact or information extracted (Mbeva et al, 2014). Therefore, obtaining knowledge or information is a major preoccupation of healthcare organizations, both hospitals, and clinics. For, until now, in North America, Europe, and developing countries, most of the information and the knowledge base on patients are still retained on paper reports or cards. In addition, the information and the knowledge base are distributed throughout the hospital without order or structure (Desouza, 2005). It is therefore increasingly evident that the development of organizational capabilities of capture, transfer, and the dissimilation of data, as well as medical knowledge and information throughout an organization, is one of the critical factors in almost all business disciplines (Earl, 2001). Hence, the development of KM capabilities (KMC) occurs through the development and utilization of specific maturity models (Ehms and Langen, 2001; Klimko, 2001; Kaner and Karni, 2004; Harigopal and Satyadas, 2001; Dayan and Stephen, 2006; Berztiss, 2002; Johnson and Brodman, 2002).

Thus, the evaluation of capabilities to capture, transfer, and dissimilate data, information, and medical knowledge of a healthcare facility based on a maturity model is indispensable. In effect, many reasons argue in favour of knowledge management within healthcare organizations, particularly (Wahle and Groothuis, 2005): 1- Hospitals and all other healthcare organizations are the central nexus for exchanging detailed knowledge and information; 2- There is an increased demand to optimize support for basic medical procedures; 3- There is a need for efficiency and effectiveness in dispensing health care; 4- Patients are increasingly more demanding regarding the quality of healthcare they receive along with medical information on their illness; 5- There is a need to exchange data, information, and knowledge between different providers (professionals and organizations); 6- An increasing number of autonomous professional disciplines intervene thus interact with the patient and need to conserve, exchange, and utilize the knowledge of the speciality in order to improve their knowledge base and their operational effectiveness; 7- Certain unique knowledge that emerges at times during the interaction of the patient-doctor relationship needs to be captured, secured, shared, and utilized.

Hence, throughout the present study, the KMC of the two healthcare organizations are evaluated as per the KMC maturity model (KMCMM) that is an integral model consisting of five (5) levels and comprising three (3) dimensions: knowledge management infrastructures, knowledge management processes, and knowledge management competency (Booto Ekionea and Abou-Zeid, 2005). This evaluation will allow us to identify the maturity level for each dimension and sub-dimension of each facility studied to seek improvements or develop the KMC. In effect, the organizations require solid avenues that can support them in the capture, conservation, transformation, sharing, and application of knowledge based on previous experiences and new methods learned in order to respond to present and future needs (Rubenstein and Geisler, 2005, p. 45).

Thus, apart from the introduction and the conclusion, the present article is subdivided into four (4) sections: 1 - Review of literature where the concepts of data, information, and knowledge are defined in the clinical and hospital contexts as well as the concepts of KMC and the maturity models; 2 - The design of the case study where we present the methodology used, as inspired by Yin (1994); 3 – The results of the case study where we present the evaluations of the KMC obtained in each facility studied with individual and consolidated results and where an inter-caste analysis is presented i.e. a transversal analysis according to the deductive method that places the accent on the importance of validating the data with the theoretical model (the KMCMM); 4 – Discussions and perspectives on the concepts of the KMC where the diagnostics, the causes, and the

challenges yet to overcome by healthcare organizations are presented and the perspectives for research on the academic level.

2. Literature Review

From a theoretical viewpoint, the present study relies on six (6) axioms: Axiom 1: Knowledge is a strategic organizational resource and likely to provide a competitive advantage and to help attain business performance objectives. Thus medical knowledge can be considered as being an ensemble of personal information versus non-personal information relative to administrative information « administrative file », medical information « medical dossier », recorded information of all events related to the patient, and the « nursing file » from which treatment is conducted, to results of epidemiological studies, to knowledge on the proper channels to maintain (therapeutic protocols, guides to proper practices), to thesaurus consultations, as well as information that is organized according to the aims of the healthcare establishment (Beveren, 2003). Weixu, Eugene and Atsuhi (2019), argue that « In the increasingly fierce competitive market environment, researchers believe that knowledge is an important organizational resource, and knowledge administration is deemed to enhance firms' competitive capability». Axiom 2: Organizational knowledge management is a difficult task that requires the development of specific organizational capabilities without which the acquiring of competitive advantage and business performance is impossible (Peppard and Ward, 2004; St-Amant and Renard, 2004). In effect, knowledge management is very important particularly in the healthcare sector because of the continuous data flux, information, and knowledge in circulation. A healthcare establishment is comprised of numerous professional specialists that contribute to the healthcare accorded to patients (Beveren, 2003). Therefore, this establishment should develop capabilities to create, diffuse or share the knowledge across the establishment to improve the healthcare accorded to patients (Beveren, 2003); Axiom 3: The development of organizational capabilities specific to knowledge management (KMC) is defined along three dimensions: KM infrastructures, KM processes, and KM competencies (Abou-Zeid, 2003; Ahn and Chang, 2005); Axiom 4: Observing the efforts or initiatives of developing or improving KMC derives from a learning curve and can only be done through a specific maturity model (Préfontaine, 1994; Peppart and Ward, 2004; Luftman et al, 2004; Dekleva and Drehmer, 2001; Venkatraman, 1994; St-Amant and Renard, 2004). In effect, the maturity model evaluates the level of success of one or more general objectives using a scale of 0 to 5 as follows: 0: non-existing; 1: existing but not organized (initiated case by case), 2: practiced (intuitive but reproducible), 3: defined (with documentation), 4: supervised and measured, 5: optimized. The current paper considers a scale of maturity levels from 1 to 5 for each dimension and characteristic of the KMC; Axiom 5: The maturity model expresses the level of performance that an establishment can achieve as a function of the level of development of the KMC; Axiom 6: The validity of this model in a context particular to the healthcare organizations studied will help to better understand the inclusion of maturity models as a diagnostic tool of KMC, and in the development processes of KMC within an establishment.

3. The importance of good management of data, information, and medical knowledge

Information of raw data is subject to interpretation by computers or human mental functions (Spiegler, 2000). Consequently, knowledge is a combination of information or observation, their inherent interpretation by people who summon their personal or collective experience, along with models, theories, or beliefs that together give meaning to the information (Prax, 2003). The concept of knowledge, therefore, relies on the range of senses, notable notions such as language, semantics, beliefs, and conscience. In effect, we acknowledge that factual information can be easily accumulated and transferred to documents or databases in explicit form, while knowledge, in a strict sense, is an element more humane, subjective, and often tacit. Hence, Nonaka (1994) distinguishes two types of knowledge: tacit and explicit.

Tacit knowledge belongs to the knowledge group of mental objects or representations. It encompasses innate or acquired knowledge, expertise, and experience. They are generally difficult to « formalize » as opposed to explicit knowledge (Nonaka, 1994). Explicit knowledge, contrary to tacit knowledge, is the knowledge that is clearly articulated in written documents or found in IT or computer data systems. This knowledge is physically transferable since it appears in tangible form (paper or electronic data) (Nonaka, 1994). Certain other knowledge-based information is dissimilated throughout the company in support of paper forms and electronic data. This knowledge must be managed to improve the global effectiveness and competitiveness of companies (Wernerfelt, 1984; Barney, 1991).

Therefore, knowledge management or knowledge engineering in this paper is understood to be the sum of all the methods and techniques that allow us to perceive, identify, analyze, organize, memorize, and share knowledge between members of organizations, particularly knowledge created by the company itself or acquired from outside.
However, knowledge management differs from one organization to another, from one industry to another, and from one contextual reality to another, hence the need to contextualize the approaches to knowledge management. In effect, the contextualizing of knowledge in philosophy is the theory according to which the attributions of knowledge can change the value of truth in the context of one conversation to another. To contextualize, one compares the word "knowledge" with other words similar in context, for example, those that change the value from one contextual conversation to another (Lewis, 1995).

Therefore, in the field of healthcare in general, especially in hospitals and in clinical settings, knowledge management is very important because of significant fluctuations of data, information, and knowledge that continuously circulate. Note that healthcare organizations are comprised of professionals in different specialties that contribute to the health and well-being of patients (Beveren, 2003). It is for this reason that such organizations should develop the capabilities to create, dissimilate or share knowledge across the entire organization in order to improve the healthcare accorded to patients (Beveren, 2003). The healthcare organizations that manage and share their combined knowledge could effectively obtain a reduction in treatment time, a reduction in costs, a return on investment, a high level of satisfaction, and sound training of medical and paramedical staff (Sharma, Wickramasinghe and Gupta, 2005: Antrobus, 1997). In addition, the medical field is faced with stringent requirements of quality and optimization of care that necessitates the management of medical knowledge. Healthcare professionals must be able to share and apply common knowledge therefore collectively valid, especially healthcare protocols that develop in numerous disciplines and presented in guidelines for sound practice, as part of the medical field that is the most protocol conscious. They must also acquire knowledge and medical expertise that will allow them to use such acquired clinical skills with their patients thus instantly applying, to the best of their abilities, general knowledge always in context with the patient before them.

In the same way, as knowledge must be shared, the responsibilities and the decisions on the type of care to be provided to patients should also be facilitated and shared within the healthcare establishment (Eisenberg, 2002). In order to do this, these organizations must develop the means to harness the knowledge and medical expertise, the protocols, sound practice guides, referenced bibliographies on medical facts and practices that are easily accessible, and facilitate their distribution in real-time throughout the establishment, etc. Thus, medical knowledge can be considered as being the sum of personal information versus non-personal information with regards to administrative information « administrative dossiers », medical information « medical dossiers », recording all events related to the patient, and the « nursing dossiers » allowing to initiate treatment, to results of epidemiological studies, knowledge on pertinent channels to retain (therapeutic protocols, sound practice guides), to a thesaurus as well as to information organized according to the aims of the healthcare establishment.

In effect, with regards to healthcare organizations, they must obtain and analyze clinical data as well as data taken from outside sources in order to visualize and organize the data into information useful for decision making (Pavia, 2001). Healthcare organizations should make available pertinent information and knowledge to consumers, patients, clinical workers, managers, directors, and other personnel (Beveren, 2003). This method of openness would help follow-ups and maintain competition between healthcare organizations that often evolve in complex and sterile environments. In effect, knowledge management in the healthcare sector implies 1 - Computerized data on patients; 2 - Telemedicine; 3 – Optimized usage and management of equipment (Rubenstein and Geisler, 2005).

Considering the preceding literature, it is easy to understand that initiatives in knowledge management bring value. However, there are major obstacles to overcome in terms of the development of specific capabilities.

3.1 Organizational capabilities specific to knowledge management

As markets become more complex and unpredictable, the ability of organizations to improve their performance increasingly depends on their competence to acquire and develop knowledge. Therefore, knowledge is considered the most important asset and is more important than other types of inputs or resources. In addition, knowledge-intensive organizations tend to strongly support knowledge creation

(Sonienwicki and Paliszkiewicz, 2019). In effect, healthcare organizations need to capture, retain, transform, store, and apply the knowledge gained from previous experience and learning in order to meet their present and future needs (Rubenstein and Geisler, 2005). To achieve this, organizations must develop organizational capabilities specific to knowledge management. This would therefore justify the pertinent inclusion of the application of a specific maturity model. This model, which integrates three dimensions, will help prepare a diagnostic of the organizational capabilities specific to knowledge management which the establishment needs to better utilize its organizational knowledge. To achieve this, the present research is designed by considering the following: 1 - Knowledge is a strategic organizational resource likely to provide a competitive advantage and to help in reaching business performance levels; 2- Organizational knowledge management is a difficult task that requires the development of specific organizational capabilities without which the goal of providing a competitive advantage along with business performance is impossible (Peppard and Ward, 2004; St-Amant and Renard, 2004); 3 - The development of organizational capabilities specific to knowledge management is defined according to three dimensions: knowledge management infrastructures, knowledge management processes, and knowledge management competencies (Abou-Zeid, 2003; Chang and Ahn, 2005).

3.2 Knowledge management infrastructure as a specific organizational capability

Technological infrastructures include the technologies that facilitate and support knowledge management, such as business intelligence, collaborative learning and training, and its dissimilation, knowledge management for discoveries, and knowledge management for various scribing needs, etc (Goh, 2005; Alavi and Leidner, 2001). In effect, « Knowledge Management Technologies include those used for creating, storing, researching, distributing and analyzing structured and non-structured information » (Herschel and Jones, 2005, p.45). Knowledge management technologies are also the best way to support knowledge sharing in an organization, through it, knowledge sharing has become much easier than face to face, and by using it as a communication tool, the frequency of the communication and knowledge sharing would be more frequent and regular (Ngah, Tai, and Bontis, 2016). This will help employees in healthcare organizations to do their jobs and save time through better decision making and better problem solving; as well as creates a sense of community ties within the organization (Sonienwicki and Paliszkiewicz, 2019). It is in this context that technologies (clinical and administrative) are crucial in defining the competitiveness of healthcare organizations (Sharma, Wickramasinghe and Gupta, 2005). The tools and specific technologies can help a healthcare establishment develop its capabilities in the acquisition, storing, sharing, and internal use of knowledge by professionals and other types of healthcare workers (Oxbrow and Abell, 1998; Sharma, Wickramasinghe and Gupta, 2005).

According to Zaied (2012), « Knowledge-based technology is defined as the technical systems within an organization, which determine how knowledge travels throughout the enterprise and how knowledge is accessed ». It is essential to ensure that the employees of the organization are well informed about the general goals and objectives of the organization and how technology can facilitate the success of these objectives, before the implementation of the technologies of the organization. knowledge management, otherwise, it will lead to disappointing returns on technology investment (Zaied, 2012). The typical technological infrastructure of a healthcare establishment can be sub-divided into a group of systems that support: (Gargeya and Sorrel, 2005, p.50): 1 - Patient care; 2 - Administrative and regulatory processes; 3 - Decision making and quality improvement; All these categories are, technologically speaking, supported by 1- Sound network architecture; 2- Hardware components; 3- Data architecture and software connectivity. To these ends, a sound technological architecture for knowledge management should be (Gargeya and Sorrel, 2005, p. 58): 1- Omnipresent, reliable, *scalable*, pliable, and secure; 2- Capable of supporting the transmission of data, both voice, and multimedia, including applications such as telemedicine and teleconferencing; 3- Use protocols and topology standards of the industry; 4 - Capable of supporting diverse requirements for infrastructure networks related to patient care, medical research, training, and administration; 5- Less costly as much for implementation as for operations. Note that information technology can improve the speed of integration and knowledge applications by automatically codifying organizational routines. Therefore, automatic systems like Workflow represent examples of applications of information technology that can help in reducing the need for communication and coordination and allowing more efficient use of organizational routines like documents, information, regulations, and activities (Alavi and Leidner, 2001). As well, expert systems based on rules are other means to capture and reinforce specific organizational procedures. Also, considering the plan for physical and information security (Gargeya and Sorrel, 2005, p.58), a sound architectural technology for knowledge management should use: 1- Fibre optics for the wiring and cables and install all electronic equipment in secure locals; Other means of protection such as firewalls are also desirable; 2- Authentication servers, security services, remote access, and e-mail management (*e-mail Gateway*). In

addition, certain security rules must be respected (Gargeya and Sorrel, 2005, p.59): 1- Administrative procedures; 2- Physical security; 3- Security configuration management; 4- Security technical services; 5- Security technical mechanisms; 6- Electronic signatures.

As for specific organizational structures for good knowledge management, Beveren (2003) notes that certain organizational structures in healthcare organizations are veritable obstacles to proper knowledge management: 1- Departmental structures within organizations are based on professional associations that are not designed for the required tasks; 2- Professionals in existing structures work essentially alone and, consequently, there is a lack of interdisciplinary fields in their ranks; 3- A dominant hierarchal structure, culturally entrenched, with many levels of management and where the distribution of information is very rigid, characterizes the majority of public sector organizations. Hence, « the theories of knowledge management are based on technological infrastructures that organize individual and collective knowledge as well as organizational structures that provide social conditions that encourage employees to share their knowledge and expertise » (Edge, 2005, p.45).

3.3 Knowledge management process as a specific organizational capability

Arias-Pérez, Tavera-Mesías, and Castaño-Serna (2019) defined KM processes as « cyclic mechanisms allowing to generate new knowledge, organizational learning and innovations ». The knowledge management processes comprise (Alavi and Leidner, 2001): 1- Knowledge creation; 2- Knowledge storage; 3- Knowledge transfer; 4- Knowledge application. This is also supported by Desouza (2005), who summarizes knowledge management processes in terms of creation, dissimilation, and utilization of knowledge within an organization. According to Raudeliūnienė, Davidavičienė, and Jakubavičius (2018), « Knowledge creation means the organization's ability to create new and useful ideas and solutions, related to the various aspects of organizational activity, from products and technological processes to management practices ». It is also important to note that knowledge creation refers to the identification of the internal or external source and by the extraction procedures that serve as inputs to the knowledge management process. As well, the capture and the storage of knowledge are the sums of the procedures and processes of their transfer to data and storage easily read by computer technology. Such codifying or transfer to data form of explicit knowledge calls upon the transfer of explicit knowledge codified in different formats to an electronic document format (Desouza, 2005). Regarding the codification of tacit knowledge, it consists of converting them to explicit knowledge in electronic form (Desouza, 2005). Thus « The use of a centralized repository facilitates the conservation of knowledge, eliminates the duplication of effort at the departmental or organizational level, and reduces costs » (Desouza, 2005, p.16). The knowledge repository permits members of an organization to use it at their leisure whenever the need arises. In effect, once stored, the information and the knowledge of the organization can be made available to facilitate access to other members of the organization (Desouza, 2005). However, only authorized persons will be allowed to manipulate the information and knowledge so stored. In regards to innovation, Weixu, Eugene and Atsuhi, (2019), argue that « KM, including knowledge acquiring, also seen as knowledge creation, sharing, and application, is considered the core driving power of administrative innovation and supports the new administrative innovation constantly. Likewise, the coordinating mechanisms of KM encourage organizational members to transfer their individual knowledge to collective knowledge and supports transforming knowledge into organizational innovative capabilities».

Regarding the use and the application of knowledge, Alavi, and Leidner (2001, p.122) state that « the important aspect of the theory on knowledge creation within an organization is the competitive advantage inherent in knowledge application as much as the knowledge itself ». As well, good process management requires specific organizational capabilities. In such a framework, Grant (1996) identifies three primary mechanisms for the integration of knowledge in the creation of organizational capabilities: Organizational directives, organizational routines, and the type of tasks given to teams. Organizational directives refer to the set of rules, standards, procedures, and instructions developed from converting tacit knowledge from specialists in explicit knowledge and in integrated knowledge for efficient communication (Alavi and Leidner, 2001; Demsets, 1991). Furthermore, by improving the size of individual internal networks and by increasing the number of organizational memories available, information technologies can permit organizational knowledge to be applied to the moment chosen or fixed (Alavi and Leidner, 2001).
It is important to know that the knowledge management process can be more effective in an organization if the employees are competent and motivated. (Raudeliūnienė, Davidavičienė, and Jakubavičius, 2018). The effectiveness of the knowledge management process depends on the competence, motivation of employees, and the infrastructure of information and communication technologies. In addition, the authors argued that

« these knowledge management processes (the process of gaining valuable knowledge, disseminating this knowledge in the organization, timely delivery, and commercial application) is important in order to improve the organization's innovative results » (Raudeliūnienė, Davidavičienė, and Jakubavičius, 2018).

3.4 Knowledge management competencies as specific organizational capabilities

This dimension refers to the nature of the competencies required to manage and execute knowledge management processes: 1 – The culture in knowledge management; 2- The motivation towards knowledge management; 3- The rewards of knowledge management; 4 – The incentives of knowledge management.

The new culture of healthcare organizations is to counter the existing culture of resistance and protection of individual knowledge (Svieby and Simons, 2002; Beveren, 2003). In effect, these organizations have the same obstacles to overcome as those in the public sector regarding the culture of collaboration in the sharing of individual knowledge as opposed to the private sector (Svieby and Simons, 2002): « There is a strong resistance to change both on an individual level and on a senior management (director) level that prevents any adaptation and reactions to environmental requirements » (Beveren, 2003, p.92). Conversely, a healthcare establishment should be an organization where the patient is at the forefront of care dispensed at the hospital. For this reason, the cooperation by the exchange of data, information, and knowledge between healthcare professionals centered on the patient and the hospital administration turns out to be crucial and supposes a change in the organizational culture (Beveren, 2003). The current autonomous culture and the « bunkers of knowledge » should be replaced by a new culture that requires cooperation, communication, training, and teamwork (Beveren, 2003; Brakensiek, 2002).

The motivation is itself the ability to facilitate continual processes for sharing and renewing knowledge, the ability to develop the human resources, and the organizational culture that facilitates the sharing of knowledge, along with the ability to utilize the available technologies to create, share, and document the knowledge. Similarly, Alavi and Leidner (2001) remind us that these organizations require a profound cultural renaissance because, traditionally, they reward professionals according to their individual performance and their competency, and not according to their capability to learn and to share what they know or have learned. As well, Alavi and Leidner (2001, p.127) affirm that « incentives are very important to remove certain major barriers to realizing knowledge storage ». These barriers include 1- The lack of time for employees to contribute to the creation of their knowledge; 2- the corporate culture which historically has never rewarded employees that contribute to the creation of their knowledge and then share with others.

The ability to facilitate the continual processes of sharing knowledge and their renewal, the ability to develop the human resources and the organizational culture that facilitates the sharing of knowledge, and the ability to utilize available technologies for the creation, sharing, and documentation of such knowledge are a few examples of the competencies required for sound knowledge management (Malhotra, 1997). As well, recent studies support that the development of specific organizational capabilities for knowledge management is best assured by a maturity model of specific capabilities (Ehms and Langen, 2001; Klimko, 2001; Kaner and Karni, 2004; Harigopal and Satyadas, 2001; Dayan and Stephen, 2006; Berztiss, 2002; Johnson and Brodman, 2002; Dekleva and Drehmer, 2001). Hence, the following section discusses the concept of a maturity model for specific organizational capabilities for knowledge management.

3.5 Maturity models for knowledge management

The concept of a maturity model, in this study, stems from the management learning school that promotes the development of organizational competencies by a learning process that increases over time and which has as its aim to shape the models for the development of organizational competencies (Cyert and March 1963; Nelson and Winter, 1982; Burgelman, 1988; Cohen and Levinthal, 1990 citation by Préfontaine, 1994). In effect, organizational learning is the way companies enrich and organize knowledge and the tasks around the activities and the culture and develop effectiveness for improving the competencies of their workforce. « Organizational maturity is achieved when the KM processes are effectively managed and applied » (Arias-Pérez, Tavera-Mesías, and Castaño-Serna, 2019). It is in this perspective that Peppart and Ward (2004, p.178) propose a competency model for information technology and argue that the expression for particular competencies depends: « (1) Persons that apply their knowledge; (2) The way by which people integrate their knowledge; (3) How people interact with others; (4) The way by which people coordinate their activities ». The work of Venkatraman (1994), Dekleva and Drehmer (2001), Luftman et al. (2004), Peppart and Ward (2004), and St-Amant and Renard (2004) on information technology and management supports the improvement of

performance levels that an organization may attain after developing specific organizational capabilities for knowledge management.

4. Presentation of the Model

Henceforth, we utilize the maturity models of the KMC developed as shown in Figure 1. This model considers five levels of maturity and is based on two hypotheses evoked by Venkatraman, (1994): 1- The lower the level of maturity of specific organizational capabilities for knowledge management of an organization, the lower is the expected benefits, whereas 2- The higher the level of maturity of specific organizational capabilities for knowledge management of an organization, the higher are the expected benefits.

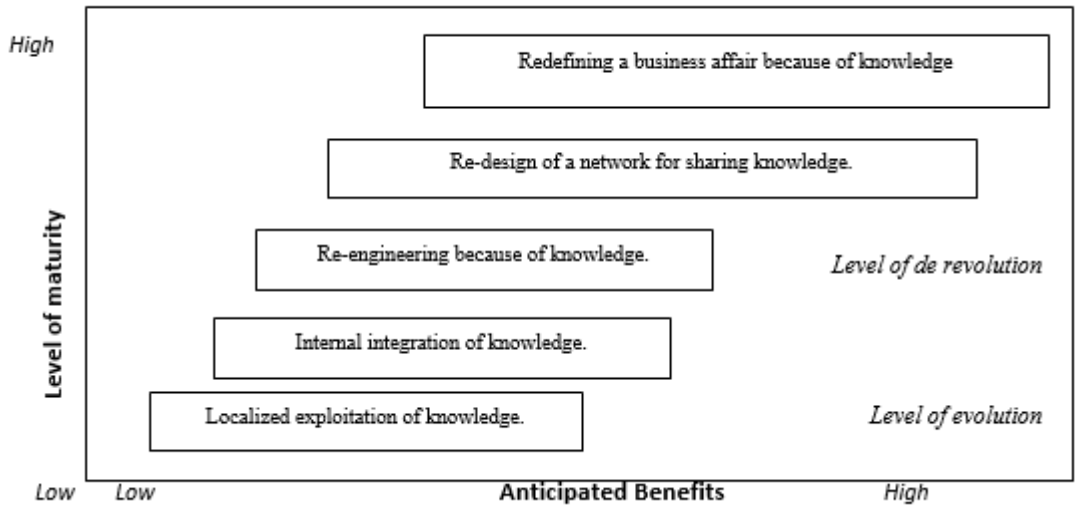

Figure 1: Maturity level of organizations by KM (evoked by Venkatraman, 1994)

We observe that the maturity levels of specific organizational capabilities of knowledge management of an organization are divided into two large categories: 1- Level of Evolution (level 1: localized exploitation, and level 2: internal integration); 2- Level of revolution (level 3: re-engineering, level 4: re-design of networks, and level 5: redefining business affairs). Hence, to better understand each level of the KMCMM, we will use the three principal dimensions as presented in the preceding section. Since we have stressed that knowledge management differs from one organization to another, from one industry to another, and from one reality to another, the following sub-section briefly presents the healthcare system of the Democratic Republic of Congo.

4.1 Summary of the healthcare system of the Democratic Republic of Congo

The Democratic Republic of Congo (DRC) is a vast country in central Africa that extends from the Atlantic Ocean to the eastern plateau and represents the major part of the Congo River basin. With an area of 2,345,000 km2, a population of more than 62,600,000 belonging to 500 ethnic black African groups, the DRC has 26 provinces with Kinshasa as its capital. With regards to healthcare, the DRC is a vast territory with social indicators that are very worrisome: 1- The infant mortality rate has gone from 125 per thousand in 1990 to 170 per thousand in 2000; 2- The childbirth mortality rate has gone from 800 deaths per 100,000 births in 1990 to 2000 deaths per 100,000 births at present (1990); 3- The average lifespan was 42 years in 2002 compared to an African average of 51 years; 4- Access to basic healthcare is less than 26 percent.

In effect, the national healthcare policy is based on the following principles: 1- The quality of care and services; 2- The efficiency and effectiveness of projects and healthcare development programs; 3- The coordination within and between healthcare sectors that dispense care; 4- Community participation; 5- Decentralizing decision making; 6- Decentralization of healthcare service facilities; 7- Integration of specialized services as part of basic healthcare services.

Thus, on a purely operational plan, the DRC healthcare system has adopted clear policies. The DRC healthcare system is operated, according to the operational plan, by the public, private, community, and religious organizations.

For the scope of the present study, two hospitals, one public, and one private have retained our attention. They are, respectively, the Kinshasa Reference Clinic and the Libanga Hospital Center, both located in Kinshasa. Note that the healthcare organizations and the entire sanitation system need to develop specific organizational capabilities that will help capture data, information, and knowledge necessary to provide quality care to patients. This would improve the efficiency and effectiveness of these organizations by a better circulation of information and better sharing of knowledge between different healthcare and sanitary workers. Consequently, a systematic diagnostic of existing organizational capabilities in these areas is required to accomplish such a task.

5. Methodology: Methods and design of Case Study

« Research methodology is a way to systematically solve the research problem. It may be understood as a science of studying how research is done scientifically » (Kothari, 2004, p.8). Also, Gauthier and Bourgeois (2016, pp.9), added that the research methodology includes at both the structure of the mind and form of the research and the techniques used to practice this spirit and this form (Fortin and Gagnon, 2016, p.190), point out that the qualitative research methodology is used to answer research questions related to complex situations or questions related to the exploration, description, and understanding of phenomena. Therefore, we chose this methodology to assess and understand the knowledge management capabilities of our health organizations under study.

Regarding the data collection of our study, we used a few methods: observations, documentary, and questionnaire as well as interviews to collect data from the health organizations and the Ministry of Health of the Democratic Republic of Congo. The analysis of our collected data will help us to produce a detailed description of our case study as well as its context as suggested by Fortin and Gagnon (2016, p.374).

According to Creswell (2009), a research design is at the intersection of the search strategy and search method. In other words, the design is inspired by the research strategy to establish the general framework that guides the research method (Bryman, 2012). We have chosen a search strategy qualitative. This presents the general characteristics among which exploration and description are the main ones. The characteristics of our research strategy chosen to conduct our research are the case study (Fortin and Gagnon, 2016, p.190).

According to Yin (1994), the case study is empirical research that analyses a contemporary phenomenon in its natural state, whenever the lines between the context and the phenomenon are not clear, and where multiple sources of proof are utilized. Other authors also argue that the case study is a research method that involves an in-depth analysis of one or more entities. It also consists of taking stock of a particular real situation, put in context, and analyzing it to discover how the phenomena that interest the researcher appear and evolve (Fortin and Gagnon, 2016, p.197). Figure 2 shows the developmental stages for the case study.

The qualitative research strategy of our study aimed to understand and assess the level of knowledge management capacities in these studied health organizations, and then, we also seek to evaluate the capacities of these health organizations to capture, transfer and dissociate the data information, and their medical knowledge. As well as their knowledge management sharing based on KMCMM.

This study has recourse to various data sources: (documents and Web site), questionnaire, and a few interviews. The paper documents and Web pages of organizations studied along with those of the Ministry of Health of the Democratic Republic of Congo allowed us to compress more thoroughly the organizational and sector-based context of the material. Thus, Contandriopoulos et al. (1990) identified three large sources of data furnished by subjects: use of documents, observations by the researcher, and use of data during interviews.

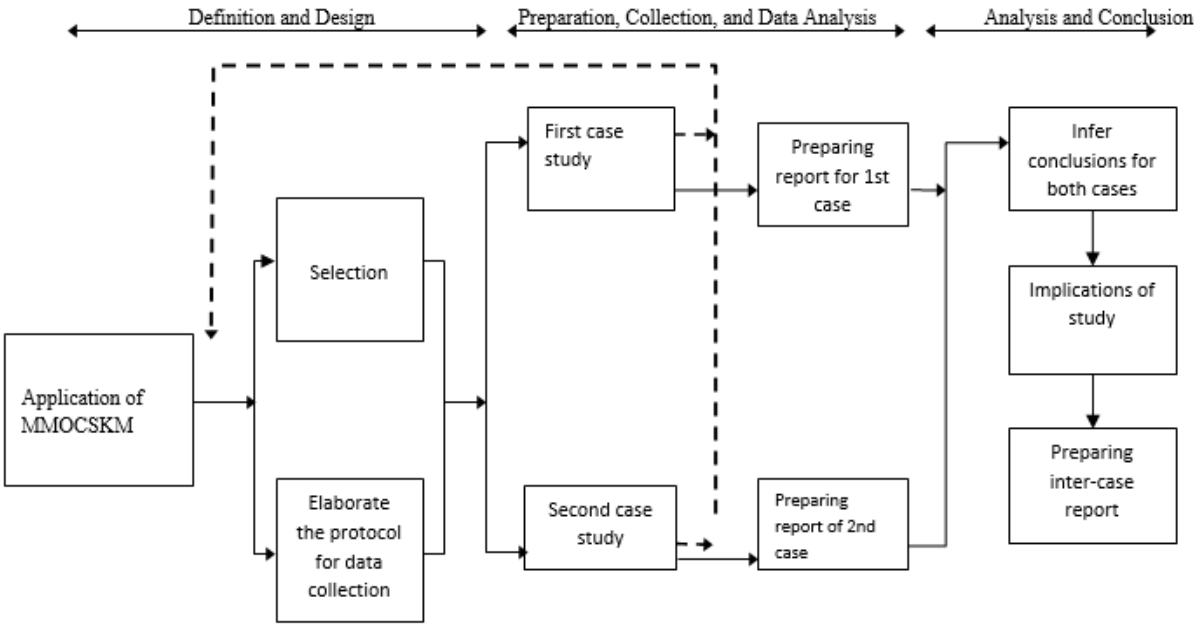

Figure 2: Developmental stages for case study (as per Yin, 1994)

6. Sequence and results of case study within the two healthcare organizations

This section will present the results of a case study of two healthcare organizations employing a maturity model for specific organizational capabilities of knowledge management (KMCMM) as proposed by Booto Ekionea & Abou-Zeid (2005). This case study thus aims to identify the maturity level reached by each of the two organizations for knowledge management capabilities in order to determine the challenges ahead for each organization. Therefore, in addition to the consolidated results presented in Table 8, the first part will examine the sequence and the results of the research at the Libanga Hospital Center (LHC), while the second part will examine the sequence and the results of the research at the Kinshasa Reference Clinic (KRC).

The LHC is a private organization yet social in nature. Opened in 1991 to help the local population, today it has a capacity of 200 beds distributed in air-conditioned rooms with autonomous sanitary installations. The LHC offers surgery, gynecology, obstetrics, neonatal, dermatology, cardiology, gastro-entomology, Hemi-dialysis, internal medicine, ophthalmology, ORL, orthopedics, urology, pediatrics, Hemi-oncology, dentistry, laboratory and medical imaging, physiotherapy, and radiotherapy, along with emergency and intensive care services.

Table 2: KMCMM - Applied in LHC and KRC

No	KM Capabilities Features (characteristics)	KMCMM Level Reached	
		LHC	KRC
1	Technology Infrastructures	1	1
2	Specific Structures	2	2
3	Knowledge Generation Processes	2	2
4	Knowledge Manipulation Processes	2	1
5	Knowledge Application Processes	2	1
6	KM Culture	2	1
7	KM Motivation	3	1
8	KM Rewards	2	1
9	KM Inciting	1	1

At the end of the inquiry, and following the format of the questionnaire, the following results were observed as shown on tables 3 and 4:

Table 3: Application of KMCMM within the LHC

Dimensions	Characteristics	LHC Diagnosis
KM Infrastructures	Technology Infrastructures	1- The professionals work manually and all of them use the paper medium; 2- The Web site does not facilitate the information exchange; 3- Absence of information and knowledge exchange policies between professionals; 4- Knowledge management efforts duplicated.
	Specific Structures	1- The medical daily meetings in the morning as KM structure are not sufficient to guarantee a significant long-term KM support; 2- Daily meetings are a good point for good knowledge management.
KM Processes	Knowledge Generation Processes	1- Absence of IT dedicated to KM and lack of their integration with medical technologies; 2- The knowledge exchanges are done verbally, or they are consigned in the paper reports.
	Knowledge Manipulation Processes	1- The knowledge manipulation processes are limited to the only entities dedicated to patient care and neither are documented nor evaluated.
	Knowledge Application Processes	1- The knowledge, information, and data sources are rudimentary and limited; 2- The rare knowledge exchanges between professionals are done at work meetings and within training seminars.
KM Skills	KM Culture	1- The KM initiatives are not the result of written and observed strategic thinking; 2- KM practices are isolated.
	KM Motivation	1- People and organizational entities are not motivated to knowledge management.
	KM Rewards	1- Lack of clear policy regarding KM rewards.
	KM Inciting	1- Absence of KM incentive measures.

The Kinshasa Reference Clinic is the reference hospital for the city of Kinshasa whose population is evaluated at more than eight million people.

Table 4: Application of the KMCMM within the KRC

Dimensions studied	Characteristics	Maturity Levels of the KMC attained by the KRC
KM Infrastructures	Technology Infrastructures	The exploitation of technological infrastructure for knowledge management is absent or limited and localized since the few information equipments available and functional at the KRC is used exclusively for bureaucratic, accounting, budgeting, accounts payable, invoicing patients, tracking professional fees of doctors and nurses, stock and invoicing, and allocation of the main ledger, etc.
	Specific Structures	There is an emergence of specific structures for knowledge management but isolated and not integrated, for there are regular medical meetings held.
KM Processes	Knowledge Generation Processes	There is an emergence of processes for knowledge generation at the level of certain internal practices since there are meetings and scientific discussions on medical issues or questions.
	Knowledge Manipulation Processes	The processes for knowledge manipulation are unpredictable, weakly controlled, and rudimentary since hospital directors do little to facilitate such processes.
	Knowledge Application Processes	There is an absence of a formal process for knowledge application, and the reaction is case by case since data, information, and knowledge are not integrated.
KM Skills	KM Culture	Culture and an organizational vision for knowledge management are absent because of a lack of policies and specific strategies.
	KM Motivation	Personnel applies locally their knowledge without assistance from the organization since efforts are rarely made except by a few persons or organizational entities.
	KM Rewards	The organization offers little motivation or reward in human resources towards knowledge management.
	KM Inciting	Success depends on the competencies of a few individuals and organizational entities.

7. Discussions and Conclusion

For this case study, Yin (1994) identifies three methods of analysis: (1) Matching a model to reality; (2) constructing an explanation; (3) chronological series. The method of analysis retained is the matching of a

model to reality, which consists of comparing a theoretical model (prediction) with an empirical model (observed) to determine the conformity between the model and the empirical reality.

Concerning the present study, the healthcare sector was chosen, and the KMCMM was applied to two healthcare organizations in order to measure its capability to diagnose an organization and to confirm the considerations at the beginning of the study.

Thus, to understand the capabilities of a research strategy to produce results that can be applied more generally to other populations, contexts, and periods, which was not our objective in this study, one must ask to what extent are the results obtained influenced by the particular context in which the research was conducted. The more solid the theory on which the research is based and the more coherent are the empirical results obtained in a context with the theoretical hypothesis, then the more these results can be generalized in other types of contexts.

For each dimension of the KMC and by comparing the results of the case studies of both organizations (see Table 2), the result of the empirical research showed us that the two organizations studied are limited in terms of KM infrastructure, which includes (technological infrastructure and specific structures), therefore, this can have a huge impact in the dimension of KMC as the technology plays a key factor in knowledge sharing in an organization. Even though the specific structures have shown a good result (see table 2), this may have a positive impact on KM in their organization, but the capacity of employees to share and exchange knowledge through technological support in both organizations is limited and may affect their capacity of knowledge exchange and sharing. According to our research results, this aspect can reduce the development of knowledge sharing and delay these organizations to reach KMC maturity. Regarding the knowledge processes, empirical research has shown a positive result across both organizations in terms of knowledge generation processes, which shows the motivation for knowledge creation in both organizations. It is important to know that knowledge creation means the capacity of the organization to create new and useful ideas and solutions, related to various aspects of organizational activity (Raudeliūnienė, Davidavičienė, and Jakubavičius, 2018). Comparing both organizations in terms of knowledge processes, The LHC has shown more positive results than the KRC. The overall review of the KMC in both organizations shows that it is possible to confirm or invalidate the observations made at the onset: « 1- the more the maturity level of organizational capabilities specific to knowledge management of an organization is low, the more the expected benefits are low, 2- the more the maturity level of organizational capabilities specific to knowledge management of an organization is higher, the more the expected benefits are higher ».

When the question is asked why a hospital needs a new system for knowledge management, Rubenstein and Geisler (2005, p. 44) answer by proposing eight reasons: « 1- create a bridge and eliminate the isolation between specialists and other organizational support entities; 2- learn from one's experience and that of other organizations; 3- avoid repeating the same errors or mistakes in many areas, notably disease management, infection control, ill-advised use of instruments and the duplication of expensive equipment; 4- support training at all levels; 5- support organizational entities that are weak or have fewer resources with the experience from organizational units that are richer and have better resources; 6- share ideas and « tricks of the trade »; 7- avoid being dysfunctional on the organizational design level, staffing, and workflow; 8- change the methods for improving productivity, cost reduction, and patient services ».

Thus, this study had identified as its objective to apply the maturity model to specific organizational capabilities for knowledge management (KMCMM) to assist the healthcare organizations studied conduct a diagnostic of their capabilities and to develop new specific organizational capabilities in knowledge management (KMC). This study proves that the diagnostic of the KMC could not be better conducted without help from a KMCMM by taking into account the three main dimensions of the KMC, that is, knowledge management infrastructures, knowledge management processes, and knowledge management competencies by healthcare personnel.

According to Contandriopoulos et al. (1990), internal validity is based on the capability of a study to put a litmus test, simultaneously, an ensemble of relations that comprise a theoretical model. The internal validity is assessed by (1) the quality, complexity, and the exhaustive nature of the theoretical structure on which the study is based; (2) the adequacy between the chosen mode of analysis and the theoretical model tested. It is, therefore, the comparison of results from the two healthcare studies that demonstrate that the two

hypotheses at the onset were confirmed (Venkatraman, 1994): « 1- when the level of maturity of specific organizational capabilities in knowledge management of an organization is low, the anticipated benefits are also low; 2 – whereas the more the level of maturity of specific organizational capabilities in knowledge management is high, the anticipated benefits will also be high ». It was thus noted that the absence of the limited levels of KMC in both organizations studied prevented them from maximizing the benefits obtained from sound knowledge management.

According to Edwards (2011), organizations, where the knowledge management has been successfully reached maturity level, are happy and may have followed the « thinking process » which, suggested 8 steps of action-oriented view of knowledge management initiative « identify processes, design processes, implement processes, facilitate processes, monitor processes, analyze processes, mend processes and retire processes » (Edwards,2011). Applying these steps could drive an efficient KMC in an organization. Our KMCMM will certainly help to assess, take out all the aspects that are holding back the development of KM and finally lead an organization to reach the KMC maturity level.

In conclusion, this paper aimed to provide best practices and improve the KM of health professionals and organizational health outcomes and general outcomes at the level of the health system in sub-Saharan Africa and the health organizations of the Democratic Republic Congo. Besides, it will help organizations determine their level of KMC maturity and adjust their strength according to their goals. Also, it supports the implementation of information technology to strengthen KM healthcare organizations in general. Such a system will bring innovation and help build a culture of innovation in all organizations and support communications that can help disperse knowledge, provide better decision making, better performance measurement, and lead to competitive advantage (Alrahbi et al., 2020).

Finally, it is possible that the results obtained from the two case studies in the healthcare and clinical sectors have a limited scope and cannot be generalized. This was not the objective of the present study. Hence, it would be enriching for the research to come to lean on larger applications of the KMCMM to find, if possible, standardization for an industry or a given context.

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Editorial EJKM Volume 18 Issue 3

Advances in Health Knowledge Management: New Perspectives

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1. Introduction

Healthcare is one of the most critical sectors in today's world, given its fundamental role in impacting people's lives and well-being.

Nowadays, knowledge management in healthcare is particularly crucial, given the significant changes and challenges affecting the field, including the recent Covid-19 pandemic (Cobianchi et al., 2020b; Grasselli, Pesenti and Cecconi, 2020), which required a fast reorganization of processes, people, tools and the need to rethink most of the sector's strategies (Cobianchi et al., 2020a; Derbyshire and Wright, 2014).

The advent of new technologies in healthcare practices is profoundly changing the whole scenario, concerning both the clinical practice and clinicians' educational needs (Au-Yong-Oliveira et al., 2021; Sousa et al., 2021). While new operating robots are affecting surgery and the skills that surgeons need to develop, automation and big data allow collecting information that can be used both for training new medical doctors as well as for innovating existing healthcare techniques (Pesqueira, Sousa, and Rocha 2020). New technologies and data availability impact internal procedures, including team management and the relationships with stakeholders, providing at the same time new challenges for the overall clinical education system. Telemedicine and e-health have become more popular as a means to address patients' ambulatory needs after the disruption and social distancing requirements due to the Covid-19 pandemic (Grenda, Whang and Evans, 2020; Miceli et al., 2021; Sorensen et al., 2020). At the same time, scientific clinical research progresses in various fields, including, for example, transplantation and organ regeneration (Cobianchi et al., 2009; Hogan et al., 2012; Marzorati et al., 2009; Orlando et al., 2013) to address the unmet medical needs of patients, and calling for a fast "bench to bedside" translation (McAneney et al., 2010).

By taking a comprehensive approach to new technologies, healthcare companies and institutions can deliver products and services more quickly, boost innovation in the industry, and hold down costs. Additional challenges include reporting and accountability, especially for those healthcare organizations belonging to the public sector (Massaro, Dumay and Garlatti, 2015). Investments required to support this technological shift must be transparently reported to stakeholders showing the growing intellectual capital of those organizations and their impact on organizational outcomes: better cure, life improvements, overcoming clinical bias, and so on (Cavicchi, 2017; Cavicchi and Vagnoni, 2017).

The above-described premise, including the impact of the Covid-19 pandemic, which hit the healthcare systems worldwide, provides new challenges for the knowledge management discipline in the healthcare and medicine sector in terms of decision-making, innovation, human resource management, business processes, intellectual capital and intangibles management and reporting, learning and education of healthcare professionals, among others. The aims of the special issue call for papers were to collect the latest trends, ideas, and perspectives about knowledge management practices in the health scenario.

2. Special Issue Papers

The papers included in the Special Issue highlight a variety of different topics.

Reference this paper: Sousa, M. J., Dal Mas, F., and Da Costa, R. L, 2021. Editorial EJKM Volume 18 Issue 3. Advances in Health Knowledge Management: New Perspectives. *The Electronic Journal of Knowledge Management,* 18(3), pp. 407-411, available online at www.ejkm.com

In the first article, Dal Mas et al. (2020b) discuss the topic of knowledge translation as the ability to translate concepts in different contexts by stakeholders characterized by various skills, goals, and even feelings. Given the features of the modern healthcare ecosystem and the presence of various stakeholders, such a topic seems central to allow different actors (including clinical professionals, scientists, policymakers, patients, …) to effectively work together (Cobianchi, Dal Mas and Angelos, 2021; Secundo et al., 2019). A structured literature review (Massaro, Dumay and Guthrie, 2016) allows the authors to describe the tools, solutions, and managerial practices gathered from the Business & Management literature about healthcare.

Knowledge translation is also the main topic of the second paper (Dal Mas et al., 2020a), which analyses a case study gathered from a Breast Unit of an Italian hospital. Results highlight the different knowledge translation tools and dynamics among the actors involved and their impact on the outcome.

Mnasri and Papakonstantinidis (2020) contribute to the literature on knowledge construction and knowledge sharing within the field of organizational communication by underlining the importance of exploring human learning contextually, descriptively, interpretively, and inductively. The paper employs a case study in oncology, offering a new framework model for exploring trivialized organizational dynamics and challenging groupthink.

Vold and Have (2020) employ a qualitative case study investigating the work relevance of an adult education study bachelor programme for middle managers of the public health sector in Norway. Results highlight how a study programme can support the development of knowledge management practices in an organization by focusing on the relevance pronounced through management practices.

In the following article, Pateiro Marcão and colleagues (2020) investigate the pharmaceutical sector, and more in details, the adoption of gamification techniques within the quality management system. Employing a case study in Portugal, the paper shows the potential of gamification techniques to boost stakeholders' engagement.

Jucevičienė and colleagues (2020) deepen the topic of organizational learning of clinicians through an empirical investigation conducted in a small hospital in Lithuania.

Martins et al. (2020) discuss the new frontiers on health by investigating edible vaccine using a mixed methodology, involving both healthcare professionals and citizens. Results highlight little knowledge about the topic, calling, therefore for dissemination and knowledge translation activities.

Cassaniti and colleagues (2020) explore a case study in Kenya to deepen online communities and networks' role to engage various stakeholders.

Therkildsen Sudmann et al. (2020) analyze the case of senior users of the online health information, highlighting how participants engage in self- and co-management of their own or others' health. Therefore, the ways information and data are managed and disseminated is crucial to facilitate this interaction.

A literature review conducted by Fernandes Travassos Rosário and colleagues (2020) on health knowledge management in the last 10 years identified the key research themes and resulting development patterns, namely, the integration and interoperability of knowledge from different sources into a single platform, occupational safety, the need to ascertain the quality and pertinent information among general web information, culture and social behaviour and data security.

Tega Enakrire (2020) studied the topic of health informatics in Africa through a bibliometric analysis, highlighting the connection with the clinical practice and the call for strategic plans.

Ferreira Polónia and Coutinho Gradim (2020) investigated the interaction of different stakeholders to identify possible partners to be involved in innovation activities, including hospitals, universities, research centres, and start-ups. Using a case study approach, the article suggests potential roles for the different parties along the innovation funnel and what they can do in each phase.

Finally, Booto Ekionea and Fillion (2020) employ a case study of two hospital organizations in the Democratic Republic of Congo, presenting a model with five levels of intellectual progress based on the knowledge

management maturity model. Results highlight the identification of the factors that influence the nature and effectiveness of the use of knowledge management practices in healthcare organizations.

The following figure 1 reports the word cloud gathered from the abstracts of the special issue papers.

Figure 1: Word cloud

3. Conclusions

The healthcare scenario is changing fast, and so do the managerial practices which should be employed to ensure effective translation, transfer, sharing, and creation of knowledge. Boosted by the inputs given by the COVID-19 pandemic, clinical, organizational, and educational practices should be rethought strategically. Efforts are required to both the academic community as well as to those engaged in the professional practice to find and apply new models and solutions.

The papers included in our Special Issue allow highlighting some takeaway messages.

First of all, most papers stress the need to foster and optimize the relations among different actors (Cassaniti et al., 2020; Dal Mas et al., 2020a; Dal Mas et al., 2020b; Fernandes Travassos Rosário et al., 2020; Ferreira Polonia and Coutinho Gradim, 2020; Mnasri and Papakonstantinidis, 2020; Pateiro Marcão, Pestana and Sousa, 2020; Tega Enakrire, 2020; Therkildsen Sudmann et al., 2020; Vold and Haave, 2020). Dedicated tools, facilitators, and procedures are needed to reach such an aim, which has become a priority of the modern healthcare sector. A variety of intriguing case studies conducted in various countries worldwide offer first-hand experiences to be shared.

In this perspective, it emerges the need to investigate further the relationship dynamics between healthcare professionals and citizens/patients (Dal Mas et al., 2020a; Dal Mas et al., 2020b; Ferreira Polonia and Coutinho Gradim, 2020; Martins et al., 2020). While the traditional paradigm was about patient-centric ethics, in the COVID-19 pandemic, public-health ethics prevailed (Angelos, 2020).

The healthcare sector's massive changes and challenges cannot but impact healthcare professionals' skillset, calling for new management and educational paradigms and techniques (Booto Ekionea and Fillion, 2020; Pateiro Marcão Pestana and Sousa, 2020).

We do hope that our Special Issue collection will offer “food for thoughts” for new exciting research avenues in health knowledge management, always trying to “bridge the gap” between scholars and practitioners.

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