

Chapter # 23

KNOWLEDGE MANAGEMENT APPROACH TO REMOTE CARE COMPETENCE DEVELOPMENT

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ABSTRACT

This paper presents a Knowledge Management approach to developing competencies among nurses working in remote healthcare. The study addresses the challenges and opportunities of hybrid healthcare environments, where professionals operate remotely from patients and colleagues. Through a case study involving interviews with remote care nurses at Finnish Heart Hospital, the research identifies key competencies required for effective remote care, such as technical skills, communication, and adaptability. The study introduces a competence development model grounded in Knowledge Management principles, particularly the SECI-model, to facilitate the transformation and sharing of tacit knowledge. The model emphasizes systematic identification, assessment, and development of competencies, supported by structured orientation and continuous education. The findings highlight the importance of regular competence assessment and knowledge sharing to ensure high-quality and efficient remote care delivery.

Keywords: knowledge management, remote care, competence development, nurses, SECI-model.

1. INTRODUCTION

Healthcare is a field that goes through major changes all the time. Challenges in healthcare come from different directions, when population is ageing, prevalence of chronic diseases is increasing, and the structure of diseases is changing. (Fukada, 2018, p. 1; Paunu and Helander, 2023, p. 213) The traditional hospital-centric care is moving towards more virtual and distributed care that takes advantage of the latest digital technologies, for example artificial intelligence, data analytics, and home-based healthcare solutions (Wehde, 2019, p. 24). This means that digital technologies can be used to answer the challenges that healthcare is facing, when continuous data collection and exchange between patients and healthcare professionals reduces the need for physical visits in physical buildings (Paunu and Helander, 2023, p. 213). Despite the promises of digital technologies in healthcare, there are still many open questions that need further research, including also such aspects as data, knowledge and digital skills (Herrmann et al., 2018; Santarsiero, Schiuma, Carlucci, & Helander, 2023).

Knowledge management (KM) refers to the operating methods in which the organization's information is refined and utilized in the management of the organization's operations (Hislop, Bosua and Helms, 2018, p. 345). It also refers to ways on how documented and tacit knowledge is shared or utilized in the organization (Laihonen et al., 2013, p. 84). Knowledge management aims to improve organizations' performance and effectiveness by addressing the importance of knowledge creation, development, organization, and leveraging (Myllärniemi, Laihonen, Karppinen, & Seppänen, 2012, p. 55).

How the organizations use the means of KM can be chosen between two strategies, which are technical and human-centered approach (Maier, 2007, p. 52). The difference between these two strategies is that the technical approach emphasizes information systems and various knowledge management applications (Laihonen et al., 2013, p. 84). Utilizing information systems requires that the information needs to be explained and coded (Alves, Lima and Gaspar, 2023, p. 193). On the other hand, a human-centred approach focuses on the knowledge possessed by the individual and its sharing and use, especially in interaction situations between people (Maier, 2007, p. 92). In this approach, the organization is seen as a learning organization where the interaction between individuals and people is supported and promoted (Maier, 2007, p. 92; Laihonen et al., 2013, p. 55).

Major focus of KM has been in capturing tacit knowledge and transforming it into explicit knowledge (Mitri, 2003, p. 174). This can be done with the means of SECI-model, which comes from the terms socialization, externalization, combination, and internalization (Nonaka, 2007, p. 284). Also, KM is based on processes and ways of utilizing information resources in which using e.g. information management process model can support organizations (Choo, 2002, p. 325). The information management process is about improving organizational performance by recognizing and harvesting the knowledge needed (Laihonen et al., 2013, p. 84).

In healthcare, to provide direct care, protect individual lives, and support activities of daily living, nurses need to improve their nursing competency (Fukada, 2018, p. 1). Nurses are expected to have an adequate competence to be able to fulfil their duties safely and effectively (Kajander-Unkuri et al., 2014, p. 795). The competence of a nurse is related to professional standards, patient safety, and the quality of nursing care (World Health Organization, 2008). Nursing competency can be defined as the functional adequacy and the capacity to integrate skills, knowledge, attitudes, and values in a specific situations of practice (Kajander-Unkuri et al., 2014, p. 796). Remote care presents several persistent challenges, thus requiring new competencies from the nurses. As remote care is characterized by the limited possibilities for physical assessment and the need to make clinical evaluations without face-to-face interaction, it requires a strong reliance on nurses' tacit knowledge and experience in complex situations. Technical and communication constraints, as well as organizational factors - such as unclear roles, inconsistent workflows, and insufficient training structures - further complicate the remote-care practices. (Helander et al., 2023) These challenges highlight the importance of systematic competence development for nurses.

In this study, we aim to answer the research question: *How KM approaches can support the competence management of nurses in remote care?* Through an action-oriented case study, we form a competence development model to be used in remote care to sufficiently monitor and develop needed competencies. Current state of competence development and competencies needed are based on interviews (n=10) with the nurses who regularly work remotely from the patients. With this, we aim to find a way to support and develop competence management in remote care.

2. BACKGROUND

2.1. KM Approaches to Competence Development in Remote Care

Competencies can be defined as the ability to apply knowledge and skills to different contexts, such as work, leisure and learning (Ala-Mutka, 2011, p. 18). It is a way to put in practice one's knowledge, know-how, and attitudes, inside a specific context (Berio and Harzallah, 2005, p. 21). Competence evolves through learning and making use of acquired knowledge and skills (Medina and Medina, 2015, pp. 280, 285; Konttila et al., 2019, p. 746).

Competence management involves the specification of an organization's competence needs, competence sourcing, the identification of competence gaps, and developing competence through training and coaching (Lindgren et al., 2004, p. 436). It constitutes of, for example, selection, training and development, performance measurement, and internal promotion (Medina and Medina, 2015, p. 286).

Healthcare is a knowledge driven function which is why healthcare professionals need information and knowledge management (IKM) in their jobs for using different devices, making decisions, and sharing information (Shahmoradi, Safadari and Jimma, 2017, p. 548). As the field of healthcare works around sharing knowledge between individuals, the focus in this paper is on a human-centred approach. It is important in healthcare to plan the KM practices that enable personal interaction between people, so that learning and creating new knowledge becomes possible (Nguyen Ngoc, Lasa and Iriarte, 2022).

There is a lot of data, information, and knowledge in healthcare. Data is often described as raw, and it has no significance beyond its existence. Data can exist in any form, and it does not have a meaning by itself (Bellinger, Castro and Mills, 2004, p. 1). Information is data that has been given a meaning (Bellinger, Castro and Mills, 2004, p. 1). It is structured data that can be used in analysis and it is often both numerical and nonnumerical (Laihonon et al., 2013). Information is well defined only together with its meaning, which can lead to problems like data silos and interoperability, as the meaning is not always clear to everyone (Orthuber, 2021, p. 2188). Knowledge is a collection of information, and it has useful meaning to its user. It is more refined and abstract than information (Bellinger, Castro and Mills, 2004, p. 1). It is often based on experience, and it is what makes possible the transformation of information into instructions. On a general level, knowledge can be defined as something related to human understanding gained through experience, studying, or thinking (Rowley, 2007, p. 166).

KM refers to ways on how tacit knowledge is shared. Tacit knowledge refers to knowledge, skills, and abilities an individual gain through experience (Nonaka and Takeuchi, 1995). Tacit knowledge is context-specified and often defined as the know-how of the person (Hoe, 2006, p. 493). Tacit knowledge is highly personal and difficult to communicate to others (Orthuber, 2021, p. 2192). In the field of healthcare, there is a lot of tacit knowledge, since it is a knowledge rich domain (Abidi, Cheah and Curran, 2005, p. 193). Means of SECI-model can help the healthcare professionals in capturing tacit knowledge and transforming it into explicit knowledge (Mitri, 2003, p. 174).

Remote care is quite a new field, where nurses work without face-to-face contact (Lau, Bartle-Clar and Bliss, 2019, p. 134). It is strongly multidisciplinary practice that includes, for example, innovative methods of practice, resourcefulness, limited clinical diagnostic support, and knowledge of public health (Smith et al., 2008, pp. 159–160). Before COVID-19, the use of digital applications in medicine were restricted to the use of electronic health records (EHRs), but lately it has been allowed to expand the use of technological devices in medicine. Nowadays, different devices include for example smartphones, mobile wireless devices, wearable devices, health portals, and implantable devices. (Eurlings, Boyne, De Boer, & Brunner-La Rocca, 2019, p. 6; Konttila et al., 2019, p. 746) Monitoring symptoms remotely has the potential to improve patients' quality of life, reduce costs, and enable timely and early treatment in situations where the need for care is increasing due to advancing illness (Walker, Tong, Howard, & Palmer, 2019, p. 78; Scalvini et al., 2020, p. 155).

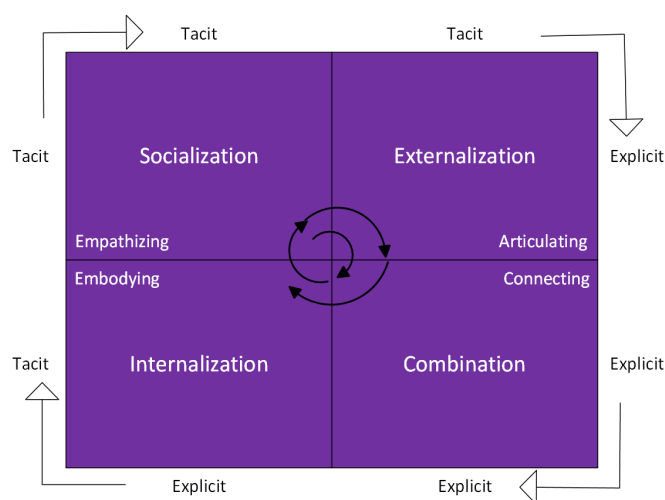
In remote care, the competencies can be seen as the skills, knowledge, and abilities required for nurses to effectively deliver healthcare services to patients remotely (Melnik et al., 2014, p. 7). These competencies include various aspects, for example technological proficiency, assessment and triage, communication skills, problem-solving, collaboration and teamwork, and professional development (Kajander-Unkuri et al., 2014, p. 799; Melnyk

et al., 2014, p. 7; Fukada, 2018, pp. 1, 3–4; Oyewunmi, 2018, pp. 430, 440; Vydrová and Bejtkovský, 2018, p. 23; Konttila et al., 2019, p. 746; Mrayyan et al., 2023, p. 6). Remote care works in a hybrid operating environment with nurses and doctors, patients, and service providers, which integrates physical and virtual care with telemedicine technologies and allows a better control of hospitals' occupancy (Pilosofo et al., 2023, p. 1). Competence in nursing is complex, relative, and variant, and a hybrid environment emphasizes all of these aspects when working through third-party systems (Nabizadeh-Gharghozar et al., 2021, p. 2).

2.2. SECI-Model Building the Base for Competence Development

SECI-model (Figure 1) describes the transformation of tacit knowledge into explicit and back to tacit knowledge in four different stages. The stages follow each other and form a spiral of knowledge, where knowledge increases as the spiral progresses. (Nonaka and Takeuchi, 1995)

Figure 1.
SECI-model (modified from Nonaka and Takeuchi (1995)).



The idea of the SECI-model is that the knowledge is socialized, so tacit knowledge is shared, and it becomes someone else's tacit knowledge (Hoe, 2006, p. 494). Then tacit knowledge is externalized, where it is shared, for example, to the whole organization, and through that, tacit knowledge becomes explicit knowledge (Laihonen et al., 2013, p. 57). After that, explicit knowledge is combined with previously known explicit knowledge (Ocholla and Adesina, 2019, p. 2). Last stage is internalization, where one adopts the knowledge on their own, and it becomes tacit knowledge again (Nonaka and Takeuchi, 1995).

SECI-model plays an important role in the field of healthcare since a significant amount of extremely vital and viable healthcare knowledge exists in tacit forms (Abidi, Cheah and Curran, 2005, p. 193). It is essential that tacit knowledge of healthcare professionals is shared in the organization, since it includes working knowledge, social knowledge, and educational discussions (Abidi, Cheah and Curran, 2005, p. 193). Tacit knowledge has a major role in improving the quality and delivery of healthcare, but it is challenging to harness and operationalize the tacit modalities of healthcare knowledge. That is why KM methods like SECI-model are needed to help to share the knowledge (Nonaka and Takeuchi, 1995).

3. RESEARCH CONTEXT AND METHOD

Empirical data was collected from the Finnish Heart hospital in Tampere and Hämeenlinna during early summer 2024. The research material consisted of 10 interviews with remote care nurses. At the same time, the literature of remote care, hybrid operating environment, and competence management was studied. The literature review formed theoretical background for this study, and the empirical research, which was done as interviews (n=10) and analysed with the means of qualitative content analysis, helped to bring the theory into practise. Combined, theoretical and empirical research formed answers to how the competence management of the nurses can be supported in remote care. Based on the analysis, a competence development model was formed.

Research interview is a conversation between two or more people, where the interviewer asks concise and unambiguous questions and listens closely the interviewee talking (Hyvärinen et al., 2017, chap. 2; Saunder et al., 2019, p. 434). The interview aims at information collecting and is therefore in advance planned goal-oriented activity (Hirsjärvi and Hurme, 2022, para. 4.1.2). The interviews were semi-structured in which the questions were basically same for everyone, but the answers were not tied to the answer options (Hirsjärvi and Hurme, 2022, para. 4.2.3). With this type of interview, the interviewer wants information about specific things and does not want to give the interviewees too much freedom. Still, the interviewer wants to clarify and deepen the answers, so there are no ready-made answer options. (Saunders et al., 2019, pp. 437–438) Interviews were held either face-to-face at the hospital or via Teams. They were conversational-like situations where the interviewees could talk freely about the topics asked. The interviewer had an interview guide to control the conversation so it would not get too off topic. Interviews were recorded so the interviewer could concentrate on the conversation and not on writing down the answers. Afterwards, interviews were transcribed, translated, and anonymized using identification numbers to strengthen the validity of our research. Translated transcriptions were coded in relation to the wanted themes, for example *Competencies*, *Hybrid operating environment*, *The amount of remote work*, and *Systems and technologies*.

4. RESULTS

In the field of healthcare, data, information, and knowledge play an important role. In the interviews, N2 said: *"We have such a big problem in the world in general that these systems produce so much data, and then we wrestle with how to find the essentials in the amount of data"*. The remote care systems produce plenty of data, and it is in nurses' hands to know which of it is meaningful. To execute safe and effective care, nurses also need knowledge. Knowledge is partly based on experience and can be gained through studying or thinking. It is needed in healthcare to provide good care and to understand how to use different systems. You also need general knowledge management to keep up with the constant changes and development, as N2 stated *"We constantly have to do some kind of knowledge management in a certain way so that we can keep up with the day-to-day work"*.

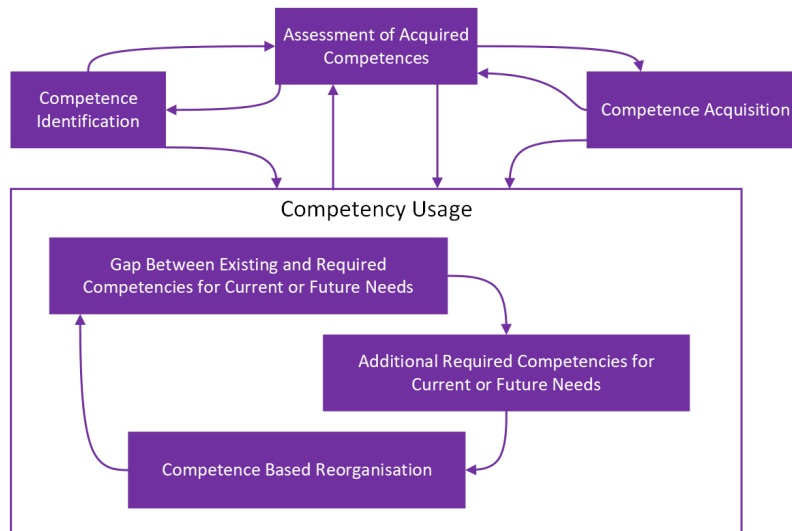
Hybrid operating environment means a wide range of things and practices in which people work. It can mean an IT infrastructure setup that combines on-premise resources with cloud-based services (Dittakavi, 2022, p. 33). It can also mean working in different places and in close collaboration with other operators (Mirbabaie et al., 2021, p. 365). In healthcare, hybrid operating environment can be seen as a use of technologies and digital solutions to implement remote care, as well as different participants working together. Hybrid operating environment needs flexibility from everyone to work properly and it allows organizations to

choose the most suitable deployment for each workload or application. (Tysowski and Hasan, 2013, p. 172; Franken et al., 2021, p. 1139) It is quite new thing in healthcare to have flexibility in work or for example where you work. Remote care allows nurses to work from home which is seen as a positive thing. *“This definitely increases work well-being, increases meaningfulness by at least 10% when you can work remotely.” (N4)*

Hybrid operating environment reduces the amount of hospital visits from patients. It gives them more freedom to live their lives although being sick. It also brings security for the patients, when they know, they are monitored all the time, and they have a backup in the hospital. Based on our research, a patient education is an important part of nurses’ work and hybrid environment can be seen as an advantage with it. In the remote platforms, nurses can send messages to the patients and ensure that patients have written instructions. Also, if patients have something to ask, they can send a message to nurses via platforms. This saves both time and resources from everyone, when unnecessary calls and hospital visit are reduced, as interviewed nurses also expect.

However, hybrid operating environment set challenges also for competence management. In overall, it shifts the competence requirements towards emphasis on digital technologies and communication skills through digital channels. Competence management is the way in which organizations manage their competencies of individuals and groups. It can be organized through competence management process (Figure 2), which helps organizations to systematically develop competencies (Berio and Harzallah, 2005, pp. 21–22).

Figure 2.
Competence management process architecture (modified from Berio and Harzallah 2005).

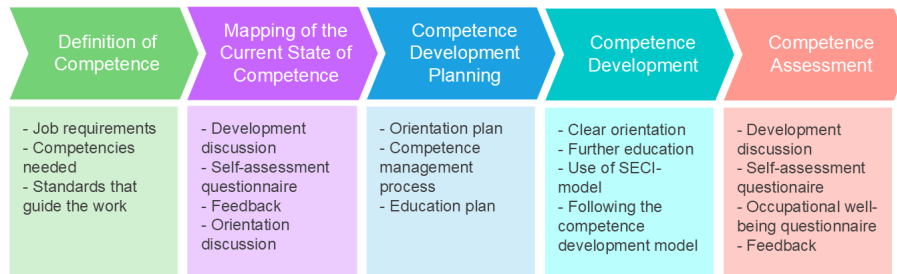


Nurses need many different competencies in remote care carried out in hybrid operation environments. 60% of the interviewed nurses mentioned technical skills and as N2 said: *“You need to know how to use all of the systems smoothly and understand their differences”*. Also, N3 said: *“Using these programs require some kind of IT skills, some kind of general knowledge of how these current systems work”*. Other competencies that were mentioned

several times, were evaluation of treatment, experience, and pharmaceutical knowledge. As N1 said: *“You have to have an eye to see, if that person fits into the program”*. Also, evaluation was seen important, since most of it is made via phone, so a nurse needs to have a competence to do the evaluation just by hearing the patient: *“You have to be able to evaluate what happens when everything isn’t quite normal”* (N8). This was also linked to experience by N3: *“Treatment evaluation, and that comes with experience. The experience is one skill.”* Experience was seen also as a knowledge from other specialties: *“It’s good that you have multidisciplinary experience, i.e., from other than the heart side”* (N1). In the interviews, nurses also pointed out adaptation to changing situations, decision-making capacity, and communication skills. As N5 said in the interview: *“It’s always easier to work so that you have a patient face-to-face”*. This emphasizes the importance of good communication skills, when interaction is limited.

Based on the literature review and the interviews from the nurses, answer to the research questions can be found. The answer consists of two paths: hearing all the remote care participants and making use of the means of knowledge management. Hearing different users gives wider perspective of what is needed when executing safe and efficient remote care. The means of knowledge management consist of systematically executing competence management process and identifying competence needs, and support in making tacit knowledge explicit. These two paths make the base for the competence developed model (Figure 3).

Figure 3.
Competence development model.



The competence development model starts by defining competencies. At this stage, the requirements of the remote care, what kind of competencies are needed in executing efficient remote care, and what standards guide the implementation of remote care are thought about. It is important to define the required competencies, so one can know what needs to be developed (Lindgren et al., 2004). Also, as healthcare is a field that is responsible for people’s lives, following standards is important. The next step is to find out what level the competencies are at the present moment. This can be done, for example, by development discussions, self-assessment questionnaires, giving and receiving feedback, or orientation discussions. By executing more than one of these, we can meet the demands of the nurses with a clear view of the current level of competencies, and what needs to be developed.

The third step is to plan competence development. At this point there should be a clear orientation plan that is used with all the new nurses who start working in remote care. Also, hospitals should pay attention to competence management model, which can help with identifying competence needs and how to develop competencies further. The model can be modified in a way that it is easy and simple to follow. It is important to follow the model

systematically. That way the hospital can ensure that the needed competencies are identified, assessed, and acquired thoroughly. The third point at this step is to have a clear education plan on how to ensure that everyone keeps their competencies up to date.

The fourth step is the actual competence development, which means the actions hospital needs to take to develop competence. This includes clear and systematic orientation to all the new nurses, further education to those who have been working in remote care longer, and the use of SECI-model. Good orientation and education will rapidly increase the competencies that are needed when implementing remote care. The hospital should have a clear orientation plan including clear steps, what new nurses need to know, and how they can acquire that knowledge. Orientation should be systematic and follow the same pattern so it could be ensured that the nurses have good enough competencies when they start working remotely by themselves.

Based on the empiria, the hospital has mechanisms for disseminating information, such as guidelines, through its platforms, but these processes are neither efficient, systematic, nor well-governed. The use of SECI-model will help nurses to spread their tacit knowledge to others and make it explicit. SECI-model also creates guidelines and instructions on how to make tacit knowledge known by everyone who works in remote care. This could be done by, for example, educating the nurses in different steps in the SECI-model and encouraging them to spread their knowledge to other nurses. The hospital could also develop a system where the nurses could share working methods that they have found effective. With this system the externalization would be easy, and many ways of working could be shared. That way everyone could find out the ways of working that fit them the best. Also, when different ways of working and knowledge acquired through time is shared in the same system, combination of explicit knowledge happens almost by itself. Thus, the internalization of knowledge is easy, since every nurse can combine their own knowledge with the knowledge others have shared and create new ways of working and increase their own competencies.

The last part in the fourth step is that the competence development model should be followed, so competence needs and gaps would be defined regularly. This means that it should be systematically taken care of that all the steps of the model are gone through regularly. Management should from time to time go through the first two steps so that they know what competencies are required and at what level they are now. Based on the results from the first two steps, the third step should be assessed, so that the orientation and education plans are up to date. The fourth step should be going all the time, so the use of SECI-model would come automatically from the nurses, and that the orientation and education would be available any time it is needed.

The last step in the model is competence assessment. Assessing competence and evaluating the development can be done by the same way that the current state of competence is done: development discussions, self-assessment questionnaire, occupational well-being questionnaire, and feedback. When assessing competencies regularly, the Heart hospital can better keep up with their current state of competency, and address deficiencies immediately. Competence development model gives them a guideline on how to assess the needed competencies and how to develop them along the way.

5. FUTURE RESEARCH DIRECTIONS

This study has its limitations, based on the location and the scope of the study. Future research opportunities include researching different fields of healthcare to give a wider look on how remote care works. It would also be meaningful to research both nurses and patients simultaneously and over longer period of time to have a better understanding of how remote

care works and what aspects need to be analysed more thoroughly. Also, it would be useful to research remote care nurses from different cities or countries, since different hospital districts may have different means for executing remote care.

As future research avenue, the role of knowledge management, especially the potential of application of SECI-model (Nonaka and Takeuchi, 1995) in competence development could be studied in more detail than in this paper. From a competence development perspective, the knowledge management approach consists of the acquisition, transformation, dissemination, and protection of knowledge and expertise (Väyrynen et al., 2015).

6. CONCLUSION/DISCUSSION

This study contributes to competence management literature by introducing a competence development model for timely context: remote care. The SECI model and the competence management process architecture have been used as the building blocks for developing the competence development model applicable in practice in remote care. The SECI model explains how nurses' tacit knowledge becomes shared and explicit, providing the foundation for learning and knowledge sharing. The competence management process architecture offers a systematic structure for identifying competence needs, assessing current capabilities, and planning development actions. Building on these, the competence development model translates both into practice by outlining concrete steps for defining competencies, assessing competence levels, planning education, supporting knowledge sharing, and conducting continuous evaluation.

With the developed model, a unified way of working can be introduced in hospitals and among them, who do remote care. Based on the interviews, there are no specific ways of developing or evaluating competencies, and sometimes even clear instructions are missing. In the future, the competence development model needs to be further developed to answer real needs of the nurses and to create concrete suggestions of working to develop remote care nurses' competencies.

Means of KM have an important role in healthcare. Nurses have much information and knowledge that is tacit, and it needs to be shared. SECI-model has many advantages, like enhanced teamwork, better organized information, it supports organizational learning (Andhika, 2025). Based on our findings, the use of the SECI model offers several benefits—such as more effective knowledge sharing for nurses and the hospital environment more broadly. Using SECI successfully is not easy, and it needs good guidelines, so the tacit knowledge can be shared effectively. Utilizing SECI in the field of healthcare would benefit all, when the knowledge gained over the years of working could be shared with everyone else, and at the same time, new knowledge that new nurses bring to the field, could be shared and combined with experience (see e.g., el Giudice et al. 2021). To help with knowledge sharing and utilization of the SECI-model, the information management process model (Choo, 2002) can be used. All organizations have information needs, but it can be hard to know what the information needs really are. Identifying knowledge gaps and that way being able to acquire knowledge would help healthcare organizations to keep up with new information that comes all the time. One part of Choo's model is information distribution, that goes hand in hand with SECI-model. Important part of both models is to distribute the information and knowledge gained to all healthcare workers so the information can be used more widely. The last part of Choo's model is adaptive behavior, and this one is important in the field of healthcare. When acquiring new information, it is not enough to get it and use it. The use of the information must lead, if necessary, to the change of behavior. That way organization can learn and keep

up with the changes. Changing behavior is necessary when the field changes as rapidly as healthcare does.

In overall, using the means of KM can lead to an efficient competence management. Based on our research it is obvious that competence management is required in remote care, since most of the work is done separately from the patient and colleagues. Especially the individual competence is needed, since it guides nurse's work and decreases the number of errors. It consists of tacit and explicit knowledge, skills, and behaviors, which is also why the different KM models are needed. Knowing one's own competencies enables the development of them, but recognizing own competence needs is not easy, which is why a competence development model is needed.

When studying the field of healthcare, ethical issues are very relevant. This research was carried out in a way that no harm, significant risks, damage or disadvantages came to the researched people. Any information from the interviewees was discussed as valuable and confidential. The research plan, data protection notice, and consent form were sent before the interviews, and each interviewee signed a consent form before the recording started. All the recordings and transcriptions were kept only until the original study was finished and only the people who contributed to this study had access to them. Also, recordings were anonymized as soon as possible to protect the identity of the subjects.

REFERENCES

- Abidi, S.S.R., Cheah, Y.-N., & Curran, J. (2005). A knowledge creation info-structure to acquire and crystallize the tacit knowledge of health-care experts. *IEEE Transactions on Information Technology in Biomedicine*, 9(2), 193–204. Available at: <https://doi.org/10.1109/TITB.2005.847188>.
- Ala-Mutka, K. (2011) *Mapping Digital Competence: Towards a Conceptual Understanding*. Available at: <https://doi.org/10.13140/RG.2.2.18046.00322>.
- Alves, J., Lima, T. M., & Gaspar, P. D. (2023). Is Industry 5.0 a Human-Centred Approach? A Systematic Review', *Processes*, 11(1), p. 193. Available at: <https://doi.org/10.3390/pr11010193>
- Andhika, L.R. (2025). The Implementation of the SECI Model in Knowledge Management Adoption Within Local Governments to Foster Innovation. *Journal of STI Policy and Management*, 10(2), 68-80. [heerps://www.stipmjournal.org/infex.php/stipm/article/view/423/pdf](https://www.stipmjournal.org/infex.php/stipm/article/view/423/pdf)
- Bellinger, G., Castro, D. & Mills, A. (2004). *Data, Information, Knowledge, and Wisdom*. Available at: <https://homepages.dcc.ufmg.br/~amendes/SistemasInformacaoTP/TextosBasicos/Data-Information-Knowledge.pdf>
- Berio, G. & Harzallah, M. (2005). Knowledge Management for Competence Management. *Journal of Universal Knowledge Management*, 0(1), 21–28.
- Choo, C.W. (2002) *Information management for the intelligent organization: the art of scanning the environment* (3rd ed.) Medford, NJ: Information Today (ASIS monograph series).
- Dittakavi, R. S. S. (2022). Evaluating the Efficiency and Limitations of Configuration Strategies in Hybrid Cloud Environments. *International Journal of Intelligent Automation and Computing*, 5(2), pp. 29–45.
- Eurlings, C. G., Boyne, J. J., De Boer, R. A., & Brunner-La Rocca, H. P. (2019). Telemedicine in heart failure—more than nice to have?. *Netherlands Heart Journal*, 27(1), 5–15. <https://doi.org/10.1007/s12471-018-1202-5>
- Franken, E., Bentley, T., Shafaei, A., Farr-Wharton, B., Onnis, L., & Omari, M. (2021). Forced flexibility and remote working: opportunities and challenges in the new normal. *Journal of Management and Organization*, 27(6), 1131–1149. <https://doi.org/10.1017/jmo.2021.40>
- Fukada, M. (2018). Nursing Competency: Definition, Structure and Development. *Yonago Acta Medica*, 61(1), pp. 1–7. Available at: <https://doi.org/10.33160/yam.2018.03.001>

- Helander, N., Pundziene, A., Sermontyte-Baniule, R., Carrabina, J., Mathieu, C., Boethius, S., & Georgescu, I. (2023, October). Digital healthcare platforms enabling remote care value creation: The patient perspective. In *2023 IEEE International Conference on Technology and Entrepreneurship (ICTE)* (pp. 38-43). IEEE.
- Herrmann, M., Boehme, P., Mondritzki, T., Ehlers, J. P., Kavadias, S., & Truebel, H. (2018). Digital transformation and disruption of the health care sector: internet-based observational study. *Journal of medical internet research*, 20(3), e104.
- Hirsjärvi, S. & Hurme, H. (2022) *Tutkimushaastattelu: teemahaastattelun teoria ja käytäntö [Research interview: theory and practice of thematic interviewing]*. (2nd ed.). Helsinki: Gaudeamus. Available at: <https://www.elliblibrary.com/book/9789523458123/tutkimushaastattelu>
- Hirsjärvi, S., Remes, P., & Sajavaara, P. (2009) *Tutki ja kirjoita. [Research and write]*. 15th ed. Helsinki: Tammi.
- Hislop, D., Bosua, R., & Helms, R. (2018) *Knowledge Management in Organizations: A Critical Introduction*. Oxford University Press.
- Hoe, S.L. (2006). Tacit knowledge, nonaka and takeuchi seci model and informal knowledge processes. *International Journal of Organization Theory & Behavior*, 9(4), 490–502. Available at: <https://doi.org/10.1108/IJOTB-09-04-2006-B002>
- Hyvärinen, M., Nikander, P., & Ruusuvoori, J. (2017). *Tutkimushaastattelun käsikirja [Research interview manual]*. Tampere: Vastapaino. Available at: <https://www.elliblibrary.com/book/9789517686112/tutkimushaastattelun-kasikirja>
- Kajander-Unkuri, S., Meretoja, R., Katajisto, J., Saarikoski, M., Salminen, L., Suhonen, R., & Leino-Kilpi, H. (2014). Self-assessed level of competence of graduating nursing students and factors related to it. *Nurse Education Today*, 34(5), 795–801. Available at: <https://doi.org/10.1016/j.nedt.2013.08.009>
- Konttila, J., Siira, H., Kyngäs, H., Lahtinen, M., Elo, S., Kääriäinen, M., ... Mikkonen, K. (2019). ‘Healthcare professionals’ competence in digitalisation: A systematic review - *Journal of Clinical Nursing*, 28(5–6), 745–761. <https://doi.org/10.1111/jocn.14710>
- Laihonen, H. et al. (2013) *Tietojohdaminen [Information and knowledge management]*. Tampere: Tampere University of Technology. Department of Information and Logistics.
- Lau, F., Bartle-Clar, J. A., & Bliss, G. (2019). *Improving Usability, Safety and Patient Outcomes with Health Information Technology: From Research to Practice*. Amsterdam, Netherlands, The: IOS Press, Incorporated. Available at: <http://ebookcentral.proquest.com/lib/tampere/detail.action?docID=5775655>
- Lindgren, R., Henfridsson, O., & Schultze, U. (2004). Design Principles for Competence Management Systems: A Synthesis of an Action Research Study. *MIS Quarterly*, 28(3), 435–472. Available at: <https://doi.org/10.2307/25148646>
- Maier, R. (2007). *Knowledge Management Systems: Information and Communication Technologies for Knowledge Management* (3rd ed.). Berlin, Heidelberg: Springer-Verlag. Available at: <https://doi.org/10.1007/978-3-540-71408-8>
- Medina, R. & Medina, A. (2015). The competence loop: Competence management in knowledge-intensive, project-intensive organizations. *International Journal of Managing Projects in Business*, 8(2), 279–299. Available at: <https://doi.org/10.1108/IJMPB-09-2014-0061>.
- Melnyk, B. M., Gallagher-Ford, L., Long, L. E., & Fineout-Overholt, E. (2014). The Establishment of Evidence-Based Practice Competencies for Practicing Registered Nurses and Advanced Practice Nurses in Real-World Clinical Settings: Proficiencies to Improve Healthcare Quality, Reliability, Patient Outcomes, and Costs. *Worldviews on Evidence-Based Nursing*, 11(1), 5–15. <https://doi.org/10.1111/wvn.12021>
- Mirbabaie, M., Stieglitz, S., & Frick, N. R. J. (2021). Hybrid intelligence in hospitals: towards a research agenda for collaboration, *Electronic Markets*, 31(2), 365–387. <https://doi.org/10.1007/s12525-021-00457-4>
- Mitri, M. (2003). Applying tacit knowledge management techniques for performance assessment. *Computers & Education*, 41(2), 173–189. [https://doi.org/10.1016/S0360-1315\(03\)00034-4](https://doi.org/10.1016/S0360-1315(03)00034-4)

1. Mrayyan, M. T., Abunab, H., Khait, A. A., Rababa, M. J., Al-Rawashdeh, S., Aljunmeeyn, A., & Saraya, A. A. (2023). Original research: Competency in nursing practice: a concept analysis. *BMJ Open*, 13(6). <https://doi.org/10.1136/bmjopen-2022-067352>
- Myllärniemi, J., Laihonen, H., Karppinen, H., & Seppänen, K. (2012). Knowledge management practices in healthcare services. *Measuring Business Excellence*. Edited by A. Lerro, 16(4), pp. 54–65. Available at: <https://doi.org/10.1108/13683041211276447>
- Nabizadeh-Gharghozar, Z., Alavi, N. M., & Ajorpaz, N. M. (2021). Clinical competence in nursing: A hybrid concept analysis. *Nurse education today*, 97, 104728–104728. Available at: <https://doi.org/10.1016/j.nedt.2020.104728>
- Nguyen Ngoc, H., Lasa, G., & Iriarte, I. (2022). Human-centred design in industry 4.0: case study review and opportunities for future research. *Journal of Intelligent Manufacturing*, 33(1), 35–76. Available at: <https://doi.org/10.1007/s10845-021-01796-x>
- Nonaka, I. (2007). The Knowledge-Creating Company: Harvard Business Review. *Harvard Business Review*, 85(7/8), pp. 162–171.
- Nonaka, I. & Takeuchi, H. (1995). *The knowledge-creating company: how Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Ocholla, D. N. & Adesina, A. O. (2019). The SECI Model in knowledge management practices: past, present and future. *Mousaion*, 37(3), 1–34. Available at: <https://doi.org/10.25159/2663-659X/6557>
- Orthuber, W. (2021). Global definition of information for global communication. In *2021 IEEE 23rd Int Conf on High Performance Computing & Communications; 7th Int Conf on Data Science & Systems; 19th Int Conf on Smart City; 7th Int Conf on Dependability in Sensor, Cloud & Big Data Systems & Application (HPCC/DSS/SmartCity/DependSys)*. 2021 IEEE 23rd Int Conf on High Performance Computing & Communications; 7th Int Conf on Data Science & Systems; 19th Int Conf on Smart City; 7th Int Conf on Dependability in Sensor, Cloud & Big Data Systems & Application (HPCC/DSS/SmartCity/DependSys), pp. 2188–2193. Available at: <https://doi.org/10.1109/HPCC-DSS-SmartCity-DependSys53884.2021.00326>
- Oyewunmi, A. E. (2018). Normalizing Difference: Emotional intelligence and diversity management competence in healthcare managers. *Intangible Capital*, 14(3), 429–444. Available at: <https://doi.org/10.3926/ic.1050>
- Paunu, A. & Helander, N. (2023). *Remote monitoring of heart failure patients treatment programme: Customer experience, expectations, barriers and conditions*. SCITEPRESS. Available at: <https://doi.org/10.5220/0012195800003598>
- Pilosof, N. P., Barrett, M., Oborn, E., Barkai, G., Zimlichman, E., & Segal, G. (2023). Designing for flexibility in hybrid care services: lessons learned from a pilot in an internal medicine unit. *Frontiers in medical technology*, 5, 1223002–1223002. Available at: <https://doi.org/10.3389/fmedt.2023.1223002>
- Rowley, J. (2007). The wisdom hierarchy: representations of the DIKW hierarchy. *Journal of Information Science*, 33(2), 163–180. Available at: <https://doi.org/10.1177/0165551506070706>
- Santarsiero, F., Schiuma, G., Carlucci, D., & Helander, N. (2023). Digital transformation in healthcare organisations: The role of innovation labs. *Technovation*, 122, Article 102640. <https://doi.org/10.1016/j.technovation.2022.102640>
- Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research Methods for Business Students*. Harlow, UK: Pearson Education.. Available at: <http://ebookcentral.proquest.com/lib/tampere/detail.action?docID=5774742> (Accessed: 19 April 2024).
- Scalvini, S., Comini, L., & Bernocchi, P. (2020). How can multidisciplinary management with remote monitoring improve the outcome of patients with chronic cardiac diseases?. *Expert Review of Medical Devices*, 17(3), 153–157. Available at: <https://doi.org/10.1080/17434440.2020.1720510>
- Shahmoradi, L., Safadari, R., & Jimma, W. (2017). Knowledge Management Implementation and the Tools Utilized in Healthcare for Evidence-Based Decision Making: A Systematic Review. *Ethiopian Journal of Health Sciences*, 27(5), 541–558.

- Smith, J. D., Margolis, S. A., Ayton, J., Ross, V., Chalmers, E., Giddings, P., ... Love, C. (2008). Defining remote medical practice', *Medical Journal of Australia*, 188(3), pp. 159–161. <https://doi.org/10.5694/j.1326-5377.2008.tb01561.x>
- Tysowski, P. K. & Hasan, M. A. (2013). Hybrid Attribute- and Re-Encryption-Based Key Management for Secure and Scalable Mobile Applications in Clouds | IEEE Journals & Magazine | IEEE Xplore. *IEEE transactions on cloud computing*, 1(2), pp. 172–186.
- Vydrová, J. & Bejtkovský, J. (2018). The importance of the individual pillars of social maturity of workers in healthcare organizations in the hierarchy of pillars of competence in management. *Administratie si Management Public*, (31), 21–35. Available at: <https://doi.org/10.24818/amp/2018.31-02>.
- Walker, R. C., Tong, A., Howard, K., & Palmer, S. C. (2019). Patient expectations and experiences of remote monitoring for chronic diseases: Systematic review and thematic synthesis of qualitative studies. *International journal of medical informatics (Shannon, Ireland)*, 124, 78–85.
- Wehde, M. (2019). 'Healthcare 4.0'. *IEEE Engineering Management Review*, 47(3), 24–28. Available at: <https://doi.org/10.1109/EMR.2019.2930702>
- World Health Organization (2008). *Summary of the evidence on patient safety: implications for research*. Available at: <https://www.who.int/publications-detail-redirect/9789241596541>
- Väyrynen, H., Helander, N., & Jalonen, H. (2015). Tietämyksenhallinta osana organisaation toimintaa–hallintaa vai hämmennystä? [Knowledge management as part of organization's operations – management or confusion?]. *Hallinnon tutkimus*, 34(4).

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