Digital EducationaL programme involVing hEalth pRofessionals (DELIVER)

RESEARCH REPORT INTELLECTUAL OUTPUT 1: NEED ANALYSIS

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ABSTRACT

Background:

This research report is part of the DELIVER project (Digital EducationaL programme InvolVing hEalth pRofessionals), a project under the Erasmus+ programme.

DELIVER is a partnership between project partners from Italy, Slovenia and Spain and Denmark, who lead the project. The overall goal of DELIVER is to *enhance the digital skills of Health Care professionals (HCPs)*. The target groups are *multidisciplinary healthcare professionals and healthcare managers* working in *the hospital and/or community care sectors*.

DELIVER will produce five intellectual outputs:

IO#1 – Need analysis

IO#2 – Organizational analysis

IO#3 – Curriculum and learning material

IO#4 – Healthcare professionals' e-learning platform (HELP) for digital skills

IO#5 – Policy and implementation recommendations

This is the research report for IO#1.

Aim:

- Determine the level and type of digital competencies health care professionals (HCPs) need to provide high quality care. Subordinate to this question: Understand the attitude and mind-set of HCPs and health care managers (HCMs) related to digitization.
- Identify the current digital competency gap among HCPs, including the biggest needs for improvement of digital competencies of HCPs and HCMs. Subordinate to this question: Investigate the existing framework and practices of training of digital skills.

Method:

The project developed a mixed method research design with a quantitative survey and qualitative interviews. Through a mixed method approach including both

quantitative survey and qualitative individual and focus group interviews, 4 partner countries have collected data for the need analysis and organizational analysis (IO2). The survey and interview guide were piloted before being translated to ensure relevance in local settings. Data was collected in the period from September to December of 2021 and involved 469 respondents. 395 HCP and HCM participated in the quantitative survey and 74 in the qualitative interviews. Respondents came from primary, secondary and tertiary sector in both samples and several authorized healthcare professions were represented.

Results:

Level and type of digital competencies

The analysis of the quantitative sample of self-reported digital competencies shows that the strength and weaknesses are quite and surprisingly similar across the countries. Respondents from the Danish sample score a little higher in average compared to Slovenia and Italy but overall, the differences are minor, especially considering the general differences in healthcare systems. The respondents are highly competent in areas of: User skills, Data – information and security and Communication & Dissemination.

The areas are related to a traditional understanding of patient care & safety, i.e. being competent in the use of a device, communicating with patients and safe patient data practice. They have comparatively lower competencies in areas of: Awareness, Implementation and Development

The areas are related to a mindset aimed at keeping up to date with emerging digital technologies, implementing them and awareness of ones shortcomings.

Attitude and mind-set related to digitization

The qualitative interviews show that digital competencies and use of new technologies are not top of mind among HCPs. HPCs primarily associate digital skills with knowing how to use digital tools – to have procedural skills and not the many other skills, such as communicating through technology etc.

Many of the same problems related to digital technologies are experienced across the four countries:

- More administration and registration and thereby time away from the patient.
- The changes are seen as a burden.
- Fear and reluctance to replace contact with patient with digital technologies.

Positive effects of digital technologies experienced across most of the four countries (though especially Slovenia and Italy do not experience all listed below):

- Faster and easier to access updated information do to uniform and centralized digital documentation.
- Share information across providers through shared systems. Better overview.
- Creates optimization of time for health care professionals and faster patient care of improved quality. Higher data security.

In addition, the qualitative analysis shows that attitude and mind-set is very important – if not *the* most important – factor when it comes to using digital technologies. Open-mindedness, interest, curiosity, patience and courage are considered very important attitudes and qualities in the digital transformation.

Potentials for improvement of digital competencies

The qualitative interviews across the countries show that HCPs and especially HCMs consider change of attitude and mind-set in relation to digital technology as a key to successful digitization. Both the qualitative and quantitative data show that there is a further need for the HCPs and HCMs to reflect on the value of digital technology and awareness of own shortcomings.

The data also shows a need for further training in the use of existing digital tools, in communicating digitally and in training colleagues and patients in using digital solutions. To some extent, there is also a need for further technological understanding and trouble shooting.

Barriers related to training of digital competencies

In all four countries – though least experienced in Denmark – HCPs and HCMs experience inadequate training in digital solutions due to lack of time and resources. A clear structure for training of HCPs in digital competencies is lacking. Self-training and learning by doing/peer support is most common and training is generally designed locally by 'super users' or IT staff.

The organizational structures do, to a large extent, not facilitate implementation of digital solutions or promote training of digital competencies and many describe a lack of adequate technological equipment and sufficient IT-support. However, this is least experienced in Denmark.

Conclusion:

Focus must be on mind-set and on training of digital skills: The role of management and organization in facilitating WHY digital technologies make sense in an every-day context and to create better conditions for getting to know new technologies and to reflect about their daily use. Training is paramount in order to realize and acknowledge their value.

Keywords:

Digital technology, digital skills and competencies, training of digital skills, digital skill level of health care professionals and health care managers, mind-set related to digitization

CONTENT

1. INTRODUCTION

1.1 BACKGROUND

This research report is part of the DELIVER project (Digital EducationaL programme InvolVing hEalth pRofessionals), which is a project under the Erasmus+ programme.

DELIVER is a partnership between project partners from Italy, Slovenia and Spain and Denmark, who is lead on the project.

The digital transformation of health in European health care systems is dramatically calling for an increased use of digital technology. HCPs are the core in accelerating the digital transformation of health and digital skills now and in the future are essential for HCPs.

Thus, the overall goal of DELIVER is to *enhance the digital skills of HCP*. The target groups are *multidisciplinary healthcare professionals and healthcare managers* working in *the hospital and/or community care sectors*.

DELIVER will produce five intellectual outputs:

IO#1 – Need analysis

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IO#5 – Policy and implementation recommendations

This is the research report for IO#1.

Given the pace of change in technology and digital work opportunities, an increased focus is on digital competencies both in the academic and professional sphere. Digital competencies, also closely related to skills or knowledge, has been used almost interchangeable, and denotes a broadening spectrum of both

hard and soft technical skills, mindset and attitudes towards the use of digital solutions in a daily context. The aim of intellectual output 1 (IO1) is to create a solid foundation of knowledge of digital competencies for the development of Intellectual Output 3, which entails developing educational material to enhance the capacity of HCPs and HCMs in handling the digital transformation of the healthcare sector.

This research report will contain the following:

- Theoretical framework and the DELIVER projects definition of Digital competencies
- Methodology and research design
- Analysis of the research
- Discussion of the results of the analysis
- Conclusion and next steps for project DELIVER

1.2 PROJECT PARTNERS AND STAKEHOLDERS

There are four partner institutions involved in the project:

- Health Innovation Centre of Southern Denmark, Region of Southern Denmark
- Università degli Studi di Udine, Italy
- Fakulteta za Zdravstvo Angele Boškin, Slovenia (Angela Boškin Faculty of Health Care, Slovenia)
- Fundació TICSalut, Catalonia, Spain

Health Innovation Centre of Southern Denmark is lead on the needs analysis (IO#1), Slovenia is lead on organizational analysis (IO#2).

All four project partners have been responsible for establishing a local reference group by identifying and engaging relevant stakeholders within their regions.

The local reference group members have been invited to participate in dialogue meetings, interviews and surveys to build the project on real and exact needs of the target group and other stakeholders.

All four partners as well as stakeholders such as; health care planners, health care managers, health care professionals, ICT professionals and educational institutions have been involved in both the needs analysis and organizational analysis. This has provided insights into digital skills needs and organizational factors influencing on the digital transformation from a macro, meso and micro level, thus incorporating the exact needs from health care organizations to healthcare workers.

2 THEORY

2.1 DIGITAL COMPETENCIES – DEFINITIONS

2.1.1 Digital competence frameworks

In the literature, digital competencies, digital health literacy, digital knowledge and digital skills and variations thereof have been used interchangeably. The different approaches to what qualities are deemed relevant in enabling engagement in the digital transformation demands a theoretical clarification. The following section will present the theoretical framework used in the DELIVER project. A framework provides a means of categorization and organization of the complexity and range of digital skillsets. Frameworks create a common language and sometimes prescribe proficiency levels or learning outcomes (Vuorikari et al., 2016; International Telecommunication Union, 2020).

For the sake of clarity, the DELIVER project will use the word "Digital competencies". Digital competence is often defined as a "combination of behaviours, expertise, know-how, work habits, character traits, dispositions and critical understandings" (Broadband Commission for Sustainable Development, 2017, p. 4). Thus, they include not only technical skills but also cognitive skills as well as non-cognitive soft skills such as interpersonal skills and communication skills (International Telecommunication Union, 2020). Digital competence can be understood as the ability to combine digital technologies, knowledge, skills and attitudes appropriate to the context. Digital competence is therefore divided into the following learning domains:

- Instrumental skills to use digital tools and media.
- Knowledge, theories and principles related to technology.
- Attitudes towards strategic use, openness, critical understanding, creativity, responsibility and independence.

2.1.2 Definition of Digital competence

The DELIVER project has built the categorization of the digital competencies of HCP´s on **the European Digital Competence Framework 2.0** (Vuorikari et al., 2016). This framework identifies the key components of digital competence in 5 areas which can be summarized as below:

1) **Information and data literacy:** To articulate information needs, to locate and retrieve digital data, information and content. To judge the relevance of the source and its content. To store, manage, and organize digital data, information and content.

2) **Communication and collaboration:** To interact, communicate and collaborate through digital technologies while being aware of cultural and generational diversity. To participate in society through public and private digital services and participatory citizenship. To manage one's digital identity and reputation.

3) **Digital content creation:** To create and edit digital content To improve and integrate information and content into an existing body of knowledge while understanding how copyright and licenses are to be applied. To know how to give understandable instructions in a computer system.

4) **Safety:** To protect devices, content, personal data and privacy in digital environments. To protect physical and psychological health, and to be aware of digital technologies for social well-being and social inclusion. To be aware of the environmental impact of digital technologies and their use.

5) **Problem solving:** To identify needs and problems, and to resolve conceptual problems and problem situations in digital environments. To use digital tools to innovate processes and products. To keep up-to-date with the digital evolution.

However, the above mentioned framework presents a more general approach, whereas the DELIVER project is specifically aimed at both digital competencies in the healthcare sector, and also at supplying HCPs and HCMs with tools to structure the training required. Bridging this topic is Norman & Skinner's Digital Health Literacy, which is defined as "the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem" (Norman & Skinner, 2006). Both patients and HCPs need to acquire digital health literacy to assess the impact of eHealth solutions and use them consciously and appropriately. However, HCPs are responsible for their patient's health literacy including the use of digital health technologies. HCPs might be expected to advise their patients e.g. on the validity of mHealth applications, how to interpret the generated data and possibly draw consequences from what the smartphone screen displays" (Mosch et al., 2019).

The DELIVER project takes a broader approach to what digital competencies consists of. It entails not just the skill to work with a specific ICT or digital

healthcare solution but also an awareness of the development in digital technolo-gies, a readiness to adapt, the necessary skills to implement and lastly, the ability to communicate and disseminate knowledge of digital technology. Based on these frameworks, we have created a framework relevant to employees in a healthcare context. This framework identifies the key components of digital com-petence in 9 areas which can be summarized as below in figure 1:

Figure 1.

Area of Digital competence	Definition	Example from questionnaire
Data usage:	Are you able to retrieve, use and use digital data with a critical stance	You take a critical stance on whether data can contribute to a decision.
Data – information & Security:	Are you aware of and capable of complying with patient rights and security measures in relation to data	You ensure compliance with the personal/patient data regulation and are aware that consent can be with-drawn.
Technological understanding:	You have a deeper understanding on how technology changes the professional practice for both clinicians and patients	You know how digitization leads to changed work processes and a different contact with patients and other health professionals.
User skills:	Are you able to use digital devices that are relevant to your work to various degrees	You can easily use digital devices and tools that are relevant to your work.
Problem solving:	Are you able to comfortably solve problems of various complexity related to digital technology	I am comfortable solving complex problems I have with a device or digital service.
Communication and dissemination:	Are you able to communicate, disseminate knowledge and reflect on when it is appropriate and when it is not to use digital technology	You ensure a personal and confidence-building dialogue with your recipient despite the limitations of digital technologies, e.g. virtual meetings and telephone calls.
Awareness	Are you able to reflect on your own strengths and weakness of your digital competencies, and awareness of where you need training	You are aware of your needs for training and updating knowledge in the field of digital competences linked to your professional practice and believe, for the benefit of patients

		and health in general, that it is necessary.
Implementation:	Are you able to either lead or support the implementation of new digital technologies	You actively contribute to the implementation of new digital technologies in your workplace.
Development:	Are you keeping up with the development within the digital technologies in your field and are you actively suggesting the use of newer technology	You stay informed about technologies under development that may have an impact on your subject area in the future

Figure 2.

In addition, there were questions on whether or not the respondent had received training on digital health and digital competencies within the last three years, how quickly they assess in adapting to new technologies, what kind of digital eHealth systems they use professionally, general experience with new technologies and digital solutions and background information. Regarding the managerial and leadership competencies for digital transformation, considering the lack of a well-established framework, the DELIVER-team derived from the abovementioned competencies, those relevant for the managerial positions.

Given these premises, the output of the need analysis and that of the policy analysis may also contribute to the development of a framework.

3 EMPIRICAL SECTION

3.1 RESEARCH SCOPE AND GOALS

The aim of the needs analysis should be to support and address the overall aim DELIVER-project. Therefore, it is important to ensure that the needs analysis of IO#1 provides a sound empirical foundation to infer and develop relevant and applicable education material (IO#3) and policy recommendations (IO#5) hereby enabling research on the level of digital competencies of the HCP and HCM, as well as the areas for improvement. To fulfill that aim, the analysis will assess the level of digital competencies of healthcare professionals (HCPs) and healthcare managers (HCMs) including perceptions on digital solutions, mindset and attitudes towards the digitization of the healthcare sector. The secondary aim is to map what digital solutions are used and considered most important. The results may be diverse according to the policy and the transformation processes enacted by the countries, as well as homogeneous and thus be relevant also for other.

3.2 RESEARCH QUESTIONS

Aims and research questions of need analysis:

1) Determine the level and type of digital competencies HCPs need to provide high quality care:

   a. What is the current level of digital competencies for HCPs and HCMs in partner countries?

   b. What types of digital competencies – and at what level – do HCPs and HCMs need to provide high quality care in the partner countries?

   c. In addition to the above mentioned research questions described in the DELIVER project description the research also focused on understanding the mind-set and attitude of HCPs and HCMs related to digitization.

2) Identify the current digital skills gap among HCPs:

  a. Based on the current digital competency level and the competencies needed to provide high quality care – and to manage digital transformation – where are the biggest needs for improvement of digital competencies of HCPs and HCMs?

  b. Within abovementioned research question, focus was on the existing framework and practices of training of digital skills.

3) Review existing national and international knowledge, strategies, guidelines and best practices relating to training or education initiatives of HCPs in preparation and implementation of the digital health transformation[1]:

  a. What knowledge and best practices relating to training and education of HCPs in digital competencies already exist in partner countries?

  b. What national/ regional/ local strategies or aims regarding digitization and digital competencies in the partner countries can be found and what do they state?

3.3 RESEARCH METHODOLOGY

3.3.1 Data collection methods

Desk research was carried out on existing programs, tools and methods for assessment of digital skills (see literature list). Based on these, research tools and methods have been developed for this project. Data was collected with a mixed method approach with a purposely-designed digital questionnaire and qualitative individual and focus group interviews.

Quantitative and qualitative data was considered as complementary – therefore a mixed-methods analysis was performed in order to combine them and to gain a comprehensive picture reflecting the complexity of the phenomenon under study. The collected data was analyzed and discussed between the partners and reference groups. All project partners were represented at a transnational meeting relating to the need analysis and organizational analysis and through a workshop, they identified the factors to be explored in carrying out the need analysis and organizational analysis.

All partners have also reviewed existing knowledge, strategies and initiatives relating to training or educational initiatives of HCPs related to the digital transformation

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[1] This research question was answered in a scientific paper published by the project partners. Therefore the results are not included in this document.

in order to identify potential gaps and opportunities to align standards. The result of this review is published in a scientific article by the projects partners.

The starting point of the data collection is the HCPs and HCMs, their digital competencies, and the areas of improvement in the rapid digital transformation of the health care system. In the project description, HCPs and MHCs – the target groups – are defined as follows:

"*Healthcare professionals and health care managers working in the hospital and/or community care sectors including HCP's which are often involved in citizens clinical and care pathways: nurses, nurse assistants, midwives, physiotherapists, dietitians and occupational therapists.*"

To ensure a viable comparison between the three national samples, the project partners agreed on a common understanding of what kind of healthcare professionals are relevant for the project. Some professions are similar like doctors and nurses, but to minimize the risk for variance all partners verified that the HCP-categories all were authorized healthcare professionals by the relevant competent authority.

The aim of the data collection protocol for the quantitative approach was set to 300 respondents in total, whereas each partner country were tasked with finding 100 respondents each[2]. The data collection protocol also included a target goal on the different sectors of the healthcare system. A split of 40%, 40% and 20% distribution of respondents in respectively the primary, secondary and tertiary sector.

HCM was also included in the sample, since in some settings the HCP will also have a managerial responsibility, as well as HCM plays a key role in implementation of new digital technologies. To achieve the aim of making an educational program for continuous professional development, students were excluded from the sample, since it might limit the relevance and applicability. The target goal for the qualitative data collection protocol was 70 respondents in total with the same target group as the quantitative survey. The interview guide was developed to be used for individual and focus group interview. Overall, a higher total respondent count were prioritized over a perfect distribution.

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[2] Fundació TICSalut, Catalonia, Spain did not send out surveys due to an overlap of another survey. They participated with qualitative data.

3.3.2 Measurement instrument description

The DELIVER projects theoretical framework is based on DigComp 2.0 (Vourikari et al., 2016). However one of the main issues with existing questionnaires, DigComp 2.0 included, are that they are mainly meant for citizens, whereas the DELIVER project is interested in investigating the digital competencies of professionals. As such the Digital Competencies Wheel developed by the Danish National Association of Municipalities & Centre for Digital Education (KL & Center for Digital Dannelse) has been of great inspiration, since it tailored to a professional context as well as it is based on the DigComp 2.0 framework. The questions were adapted to a healthcare context, just as well as questions that were not relevant were removed.

The survey items have been measured as self-assessed digital competencies within 9 different areas and also includes questions on background data, experience with digital technologies, perception of organizational readiness, desired areas for improvement, experience with training of digital competencies and use of digital technologies and ICT (HCP to HCP & HCP to patient). The items measuring the digital competencies had a standard 7-point Likert scale with a neutral option as shown below. When relevant the questions score were reversed during the data processing. To ensure item accuracy, every question had a quick briefing of the item-scale. When relevant an item was followed with a relevant work example to minimize misunderstandings.

The questions in both the survey and the interview guide were reviewed by the local reference groups as well as piloted by HCP and HCM to ensure relevance and measurement validity. In that sense, the questionnaire were standardized across the partner countries, however the examples/explanatory text for the items were adapted to a local context. The interviews were adapted and tailored to the specific needs of participants and their educational/training background. In addition, given that the qualitative and quantitative data were considered as complementary – a mixed-methods analysis was performed in order to combine them and gain a comprehensive picture reflecting the complexity of the phenomenon under study. Therefore the conclusions drawn from the research report of IO1 should be read together with the research report of IO2 for a more holistic perspective on the research subject; digital competencies of healthcare professionals.

3.3.3   Description of the sample

The data collection period lasted from September 2021 to December 2021 and involved 469 healthcare professionals and healthcare managers who participated in either the survey or interview performed by all partner countries. The project partners were individually responsible for distributing and recruiting respondents for the survey as well as the interviews. 395 respondents completed the survey and 74 respondents participated in the interviews. Both samples had respondents who worked in all three sectors with the following professions: Nurses, midwifes, therapists (physiotherapists/ occupational therapists), physicians/doctors, psychologists*, healthcare managers with personnel responsibility over HCP's and health care managers (human resource managers, general service managers and managers responsible for education/training of HCP´s, secretary and administrative role**, social and healthcare assistant**[3].

In every partner country there has been conducted qualitative interviews and/or focus groups with between 11 and 25 respondents. The quantitative sample consists of 395 respondents in total who completed the survey with respectively 101 respondents in the Danish sample, 175 in the Italian sample and 119 in the Slovenian sample. The median for the background/descriptive data sample is shown on the national level and combined.

	Denmark	Italy	Slovenia	Combined
Gender	Female	Female	Female	Female
Age (years)	46	44	43	44
Professional	Nurse	Nurse	Nurse	Nurse
Work experience (years)	16-20	16-20	16-20	16-20

Figure 3.

Minor differences appear between the quantitative national samples but looking at the distribution in the median for the national sample no significant differences are found. The educational level of the national samples is similar to the majority of the national samples (and median) being either a bachelor's degree or professional degree[4].

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[3] * denotes only for the qualitative sample, ** denotes only quantitative sample

[4] Bachelor's degree and professional degree has been merged into the same.

Analyzing the distribution of respondent's work sector, some deviation from the data collection protocol appears. While the distribution of the respondents across the Danish and Slovenian sample are primarily evenly split between the primary sector and the secondary and tertiary sector, the Italian sample differs with a majority of the respondents work in the secondary and tertiary sector.

However, the Italian sample is bigger than both the Danish and Slovenian sample, which means that there are 30 Italian compared to 42 Danish and 64 Slovenian respondents who work in the primary sector. Looking at the combined sample, Denmark has 34.4% respondents in the primary sector and 60% working in the secondary and tertiary sector with the rest working in other sectors. Thus, the deviation is within an acceptable range.

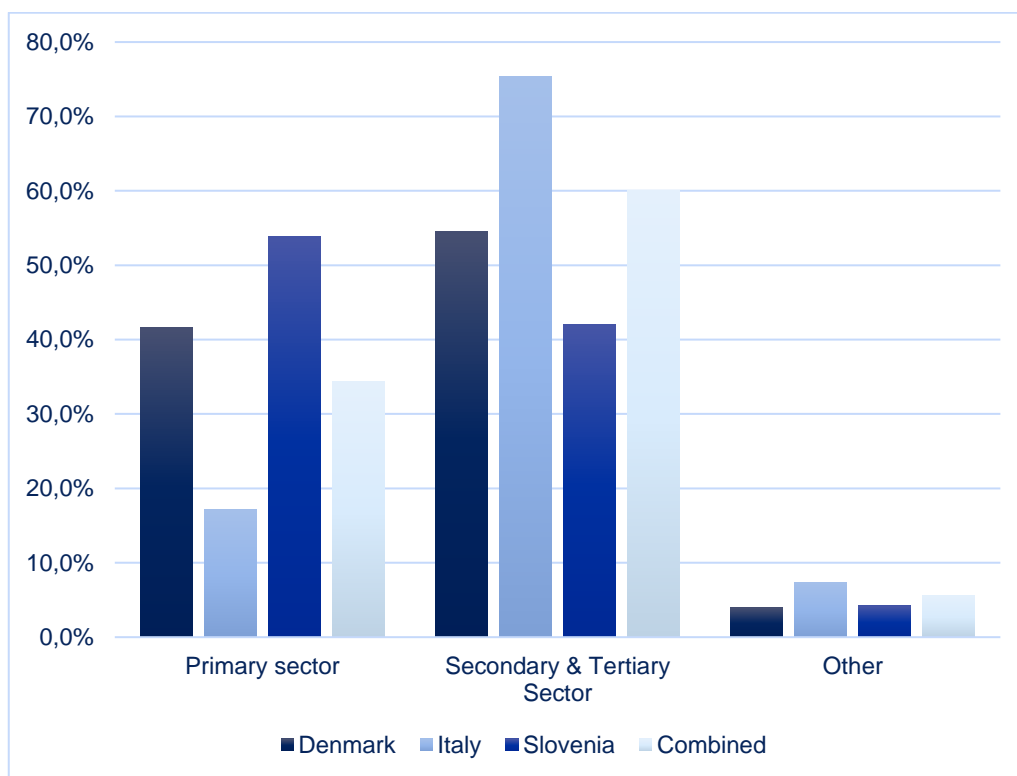Quantitative survey - Sector in which respondents work:

Figure 4.

The qualitative sample consists of 74 respondents with respectively 18 in the Slovenian sample, 20 respondents in the Danish sample, 25 in the Italian sample and 11 in the Catalan sample. The respondents were also asked to answer question in relation to IO2.

There are clear similarities between the quantitative and qualitative sample when looking at distribution of age, gender and work sector with the majority being female respondents (ca. 81% across all three countries), more than 25 years of work experience and working in the secondary/tertiary sector. The main differences are in the qualitative sample, percentagewise, there are more interviewees having managerial and personnel responsibility and that in the quantitative the majority of respondents by a large margin is nurses.

This can be considered a strength in the analysis, since it gives another perspective on the HCPs' digital competencies, where they can improve, and what consequences it has on the digitization of the healthcare system. In essence, the data collection protocol was complied with a larger sample than expected for both the quantitative and qualitative sample. Therefore, the external validity of the research reports findings can be considered high. The minor differences between samples will be taken into account when making generalization/infer from the analysis in remaining intellectual outputs.

3.3.4   Data processing methods

The interviews were condensed into a grid that summarizes the key findings of each countries. The grid contained predetermined categories, background information of the interviewees and relevant quotes from the interviews. Gathered material (transcripts) was organized around key research questions which included:

- Perceptions on digital health and digital transformation
- Current use of digital solutions
- Digital solutions considered most important
- How digital solutions affect the ways work is accomplished
- Area of need for improvement of digital competencies
- Types of digital skills considered important regarding the use of digital solutions
- Decisive elements influencing the application of digital solutions
- Advantages related to digital technologies in professional practice
- Problems related to digital technologies in professional practice
- How digital technologies are introduced and trained and how training is organized
- ICT support structure

Analysis of qualitative data followed these topics and was then analyzed following the research questions. Main conclusions were drawn for each research question separately for HCM and HCP. Typical quotes were selected for each topic/research question by HCM and HCP. Answers to research questions as well as quotes were translated to English and gathered across the project partners.

The quantitative data were three separate datasets that were recoded and merged into one combined dataset. To identify the respondent's country of origin, this was added as a variable. The data were processed in IBM SPSS Statistics Version 28.0.0.0 (190). During the data processing, a syntax has been provided with a description of each step to ensure transparency and reliability.

For the analysis of the digital competencies 9 indexes were created. The maximum possible score is 100% and lowest 0%, where a high score suggests that the respondent is considered digital competent in that area. The statistical analysis was tested with a listwise deletion. To check the robustness of the results, the imputation technique *replace with means* were used, with no significant changes.

4 RESULTS

4.1 DATA ANALYSIS

4.1.1 Quantitative analysis

Digital competencies – a holistic approach

Digital competencies is not just being able to use a digital device, but involves different areas of expertise that are not mutually exclusive to each other. However, to be fully digital competent high scores are required in all areas. The different areas in the graph reflects an index (scaled 0-100%, 100% is highest degree of competence in the area) that are based on 3 to 7 survey-items. In the graph below are the means of the respondents filtered by country and combined.
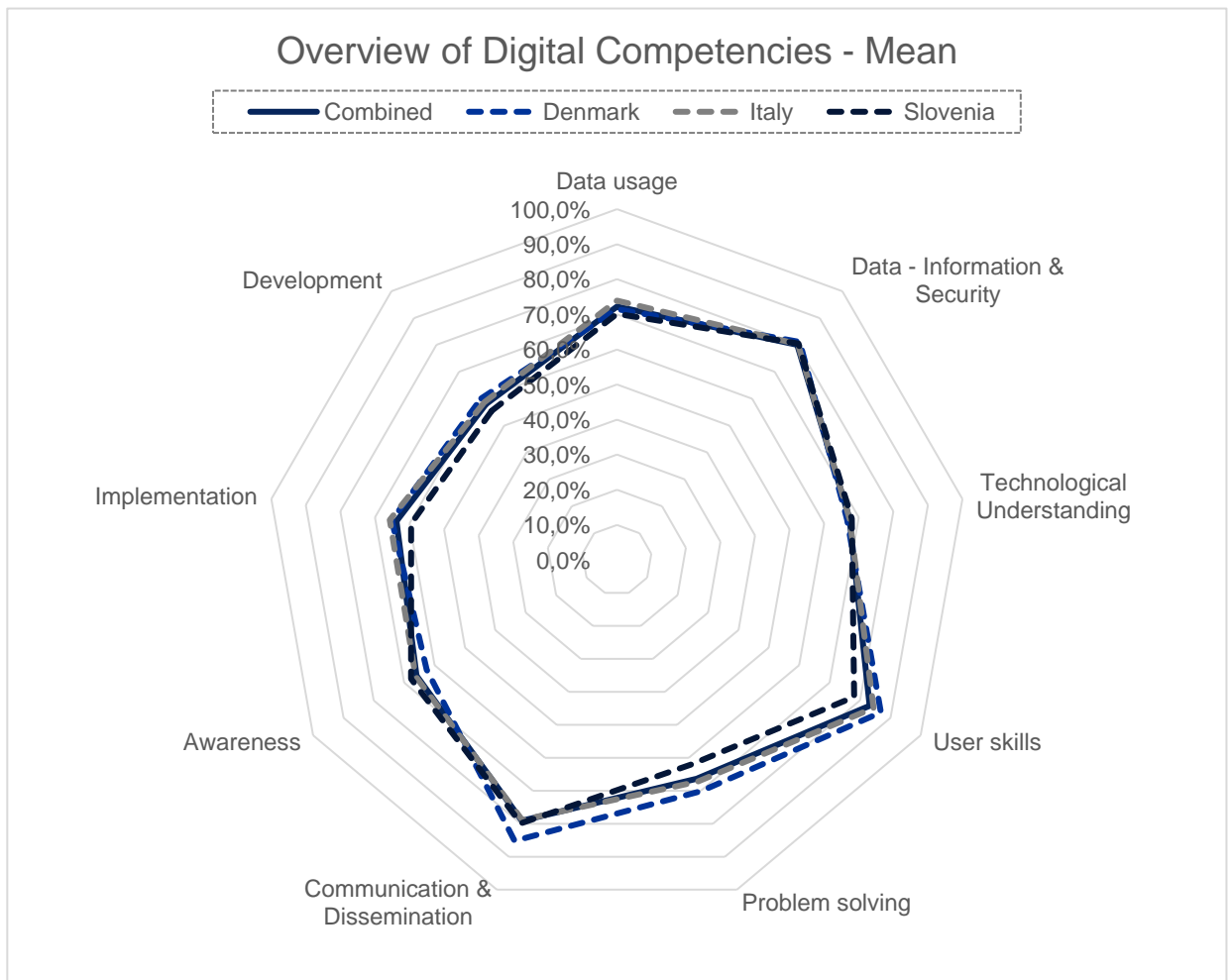

Figure 5.

Even though major differences appear in the healthcare system, the HCPs score quite similarly across all samples. There are minor differences, but they are so close that it is near impossible to distinguish between the samples in the graph. This is somewhat surprising given the differences between the countries' healthcare systems.

Generally speaking, the average user is quite versatile and particularly digital competent in areas pertaining to *user skills*, in which the average user scores 83.2% out 100%; Denmark having highest at 86.9% and Slovenia having the lowest score of 78.1%. The index items cover whether the respondent assess themselves in their ability to use digital devices and work related IT-systems skilfully. Another area showing high competency among respondents is *Communication and Dissemination*. The combined average score is 79.1%; Denmark scoring highest by 85.2%, Italy scoring the lowest by 78.9%.

Communication and Dissemination is an area where respondents assess their own competencies in communicating through digital technologies, and if they are adept in conducting peer-to-peer (colleagues and patients) training. The third highest score is *Data – Information and security*. The combined average score is 80.0% with Denmark scoring highest with 81.1% and Italy scoring lowest with 79.9%. However, the difference between the countries is about 1%. This suggests that on average the respondents are competent and aware when it comes to matters pertaining to patient rights, handling of data and general aspects of information security.

While on average the respondents assess them as highly competent in *Communication & Dissemination, User Skills* and *Data – Information & Security,* there are still some areas of digital competencies that are comparatively lower.

Development is on average the area where the respondent score lowest with a combined average of 58% with Denmark having the highest score of 60.1% and Slovenia the lowest with 55.5%. *Development* indicates that the respondents, in their own eyes, do not consider themselves competent staying updated on the newest developments in digital solutions in healthcare and reflection on its feasibility on their own work place.

Another area where respondents view themselves as not being competent in is *Implementation*. The combined average score in the area of *Implementation* is 63.8% with Italy scoring the highest with 65.7% and Slovenia scoring the lowest with 59.5%.

A respondent competent in the area of *Implementation* would be in the forefront when it comes implementing new technologies, does not need much training, and can help others with a quick transition to the new digital technology.

The third lowest average score is *Awareness* with a combined average score of 65.9% with Slovenia scoring the highest average of 67.7% and Denmark the lowest with 62.6%. Awareness indicates whether or not the respondent is able to reflect on their own digital competencies, their strengths and in which areas that they need improvement.

Summarized, the digital competencies of the respondents are quite versatile with strengths in communication & dissemination, user skills and data – Information and security. They lack competencies when it comes to implementation, development and awareness.

Digital Competencies – A view on professions

One of the aims of the DELIVER-project is to investigate and analyze gaps in terms of digital competencies – both when it comes to differences between countries but also differences between professions. The spider graph (Figure 6) gives a quick overview of the differences in different areas of digital competencies between different professions. Besides nurses, some of the other professions sample are comparatively low, which means the conclusions inferred has to be conservative. For example the doctor graph is based on a sample size of 25 and 16 HCMs.

Generally, the graph of the HCPs follows a similar pattern. There are some differences, notably the doctors scoring on average the lowest on all parameters. In particular when it comes to *problem solving* but also competencies in *Implementation* and *Development* are lower compared to other healthcare professionals.
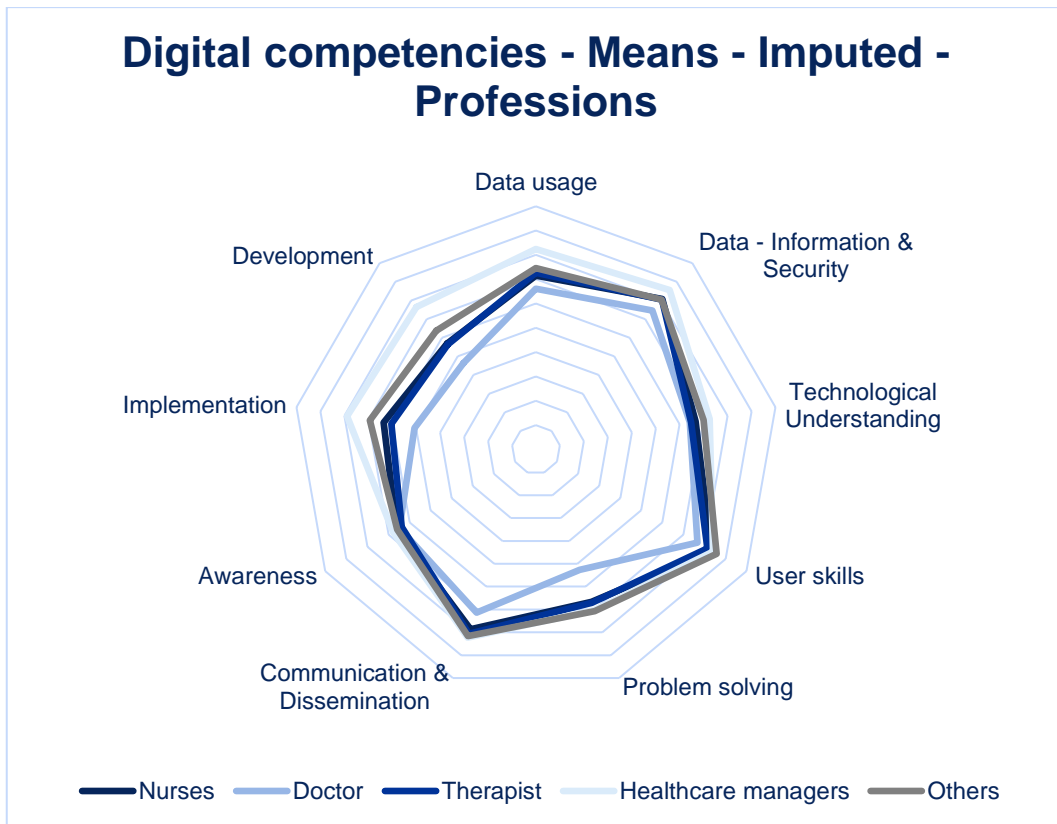
Figure 6.

HCMs score themselves highest on all parameters and there are high gaps compared to HCPs when it comes to *Development*, Data *Usage*, and *Implementation*. This is positive considering HCMs often will be in charge of researching new digital technologies and implementing them.

The majority of the sample consists of nurses (n=231) and physio- and occupational therapists (n=52) follows the same pattern with minor differences. They score quite high *in User skills, Communication and Dissemination and Data – Information and security*. However, they still require competencies in areas of *Development, Implementation and awareness*.

4.1.2   Qualitative analysis

The potential and risks of digitization of the healthcare system

"Well, to me digital health means different technological solutions, such as apps for phones, for smart devices, that help us manage our health or help us get healthy when we are sick." (Slovenia)

Faster and easier access to information due to uniform and centralized digital documentation and the ability to share information across providers through shared systems and integrate data for a better overview are seen as the most significant advantages of digital technologies across the countries. This creates optimization of time for HPCs and faster patient care of improved quality and with a higher data security due to real time documentation, ability to view historic data, e-referral, e-booking, systems for sharing data and communicating with patients, more secure storing of data etc.

Not all countries experience all of the advantages though. Slovenia also stresses the improved transparency as well as systematic collection of data accessible for research. Denmark mentions automation of routine tasks for smarter use of resources and fewer human mistakes. Denmark also mentions another advantage is flexibility and transparency for both the HCPs and the patients.

Easy access to updated data for both professionals and in some cases also for patients is seen as one of the biggest advantages of digital technologies across managers from all countries. In Catalonia the agile, personalized, and accessible communication and the ability to share information quickly and avoidance of human errors are stressed as key advantages.

In Slovenia and Italy, managers emphasize that digital technologies makes it easier to measure and demonstrate performed work and have access to updated information on not only patients and staff but also on workflows/main indicators (e.g. number of beds occupied). Order transparency as well as improved legal compliance have also been a positive consequence according to Slovenia.

"I feel more competent in managing my unit" (Manager, Catalonia)

Among the interviewees is a strong consensus, both among HCPs and HCMs, of an urgent need for digitization. On the downside, however, the transformation also leads to radical changes in the workflow and can lead to wastefulness and frustration. That may lead to resistance against new digital technologies, especially when HCPs feel that the promising potentials of the digital systems are not realized. As mentioned by Catalonia, there is still a long way to go to digitize the sector. In Denmark, the managers add that digitization is harder for the HPCs than for the patients/citizens.

"I am becoming an administrative worker. Just like most doctors in family medicine. I will spend five minutes with the patient and then spend fifteen minutes on

administrative work. I spend three times as much time because there is a lot of making appointments and changing appointments." (Health Care Professional, Slovenia)

On the other hand, the HCMs across the four countries agree, that digitization is inevitable and generally leads to a better healthcare system with more efficient workflows and better services for patients. Especially, considering a future scenario with fewer hands and more complex issues.

"Digital health still has room for improvement (…). If we were fully digitized, we would spend much less time interacting with computers to access to information, and we would spend more time on patient care, improving the quality of care"
(Catalonia)

Italy mentions that it also increases the work load and the risk of detaching the managerial role to the staff and the staff relation to the patient. Catalonia mentions the higher dependency on technology and Slovenia the lack of integration between systems across health care sector, which deprives them of many of the advantages of technology. In Slovenia, there is still much double work (digital and paper) and groups that do not use digital solutions and lack access to patient history and information from other parts of health care sector.

The use of digital health services and devices in every day practice

"We have IT systems for everything in Denmark. We must know everything ourselves. The municipalities do not use paper much." (Manager, Denmark)

Electronic health record is considered the most important digital system in all countries for both HCP and HCM. Digital solutions, especially for documentation/registration, referral, prescription, booking and communication (data sharing, SMS/email, online meetings, apps), are widely applied in hospitals and primary sector in all countries, although there are differences in the level of integration and implementation between the countries and within each country. In Denmark, the general level of digitization is described as high, whereas Slovenia describes there is a lack of cohesiveness in the implementation as well as some areas are not digitized as of yet.

The second most important digital solution are communication tools for example between staff within and across sectors or even with patients. Italy and Catalonia

also highlights the importance of digital devices that support onsite care; "*Being able to carry a tablet computer with access to EHR facilitates their work in homecare and improves the quality of care." (Catalonia)*

For example, in Denmark, portable devices are used to show instructional videos and exercises.

Generally speaking, the most important digital solutions are related to increasing the accessibility to organized, relevant and professional health information. Second most important are electronic communication systems for example online meetings both with peers, patients or combined. There is a consensus that the potential of digital solutions and digital devices are great. The potential are most likely realized, when it is implemented on a large scale, for example integrated into a national digital infrastructure. If not it can lead to frustration, increased workload and raise resistance to further implementation of digital solutions.

Types of digital skills/competencies consider most important for HCPs in relation to the use of digital technologies

"We are always concentrated on skills and competencies - but digitization requires a systemic approach - therefore more complex skills." (Italy)

All countries stress the importance of knowing how to use the digital systems and devices in one's workplace. Italy adds the importance of considering basic and specialized abilities. The ability to access digital information and communicating digitally is widely considered important. Slovenia also emphasizes focus on data security and production of digital content as important.

Managers in Catalonia stress the importance of data access, management and analytics, network communication and collaboration and development. Catalonia notes that HPCs primarily associate digital skills with knowing how to use digital tools – to have procedural skills and not the many other skills, such as communicating through technology etc.

"Curiosity and the interest and willingness to work with and get acquainted with new solutions is crucial. Employees must dare to embark on digital technologies. If you have the will and the interest you will acquire the necessary competencies." (Denmark)

Most countries mention attitude and mind-set as highly important – if not the most important – factor in relation to the use of digital technologies. Open-mindedness, interest, curiosity, patience and courage are important attitudes and qualities in the digital transformation. In addition, age is mentioned by most countries as an important factor as it is harder for older professionals to acquire digital skills than for the 'digital natives'.

Italy mentions that the ability to prevent fatigue related to continuous connection is also important to consider. To aid the HCPs, the managers in Denmark empha-size their own responsibility in encouraging and supporting HPCs in training their digital skills and in using peer support as well as their responsibility to facilitate a mind-set change creating an experience of meaning and necessity of digital solu-tions.

"As managers, our job is to make employees see the need for and benefits of digital technologies. We must make sure that health professionals make the nec-essary changes in order to take advantage of the digital opportunities."
(Denmark)

The need for digital competencies – A paradox

"Upskilling digital competencies is necessary now, but it will be even more neces-sary in the near future as we are constantly collecting more data to build insights and getting even more supported by digital tools" (Catalonia)

From all the countries the interviewees, both HCPs and HCMs, agree that digital competencies are becoming more and more important following the increased demand for digital technologies in the healthcare sector. Most countries empha-size the general importance of upskilling in using existing digital tools, especially the digital health record and other digital information systems as well as improve skills to communicate digitally. Italy mentions the importance in improving these abilities especially for the older generations.

The paradox here is that despite the strong advocacy for digital competencies, the general experience is, that there are no clear structures for training of HPCs in new digital technologies in the four countries and the training is considered in-adequate. Self-training and leaning by doing, often with peer support, seems to be the most common way for HCPs to acquire digital skills.

"There is practically no training ... We had no training, we were just informed one day that from today on, we're working with eReferrals." (Slovenia)

"The current approach is not enough (…). The HIS has an impressive potential but the current training is not effective. There are courses available, but their completion is voluntary. The reality is that many HCPs take the hours that they have to do training to do care tasks, as they have usually a lot of work to do in a short time." (Manager, Catalonia)

In Denmark, the implementation of larger digital systems like a new electronic health record includes an elaborate and relatively well structured introduction and training process based on the training of 'super users' who train their colleagues. In Catalonia different private institutions or associations provide training for HCPs. However, most consider themselves self-learners when it comes to digital competencies. Inadequate training both in terms of lack allocated of time and re-sources is especially a problem for older generations who adapt slower to new technologies, and training materials often consist of online training, videoconfer-ences, guides and other materials developed locally or from e.g. the provider of the solution. All countries also mention data security/privacy policies as an obsta-cle to using digital solutions as this can limit the access to and possibility to share information. Another problem mentioned by Italy, is that digital solutions are often piloted which leads to double work or documentation. Another disadvantage is that students use analogue tools (paper and pen) when trained as they are not allowed to access to digital solutions because they require passwords not pos-sessed.

At the same time, Catalonia finds that HPCs often do not acknowledge that they have a need for training their skills as they find that they know how to use the dig-ital solutions at work. Denmark, on the other hand, stresses the need for ongoing online and physical training and time to practice, as systems are constantly up-dated and changed. Denmark also mentions the importance of the ability to reflect on the value of digital solutions.

The change of mind-set and ways of thinking is generally seen as important across the countries. Skills to train/educate colleagues and patients in using digi-tal solutions is considered important by most countries. However, not all competencies are relevant for all HCPs. Slovenia finds that learning about data security is important for general physicians, tertiary level clinics and physiothera-pists, but not for nurses who do not find security and GDPR a problem. Skills for

information gathering is seen as an important area of learning for general physicians. Skills for production of digital content is considered important for tertiary level clinics and physiotherapists when information systems are adopted.

Catalonia mentions that HCMs need hands-on training in data management and analytics and in some cases basic automation office. The other countries do not mention specific needs for upskilling of HCMs apart from needs that also apply to HCPs.

Enablers and barriers for sustainable implementation of digital solutions in professional practice

"The implementation of new tools involves demonstrating to active HCPs that they are useful to complement the tools they already use in their work, especially if they manage to reduce the time to perform a task, which will break the possible resistance to change." (Catalonia)

However much frustration new digital technologies cause, everyone agrees that the overall potential for their viability is still valid. However, improvement in the implementation process is necessary to reach sound sustainability. The utility and meaningfulness of digital solutions are the most decisive elements for whether or not a digital solution will be taken into use. Also important is whether or not it facilitates work and improves quality for HPC and patient. This is agreed upon by most countries and managers must play a big role in conveying the value of using new digital technology. Motivation and positive attitude of HPCs towards digital solutions is likewise mentioned by most as important for successful application. In addition, the patients' attitude and ability to use digital technology is mentioned as important.

"It must make sense in a busy day and patient safety must not be compromised. It must meet existing needs and be a help in everyday life; be able to help the patient, be time-saving, facilitate task solution, etc." (Denmark)

The usability/user friendliness, stable functionality and easy access to the device, which should be up to date, are also crucial factors in all countries. In the case of Slovenia and Denmark, it is mentioned that frustration can arise when digital solutions are not self-elected, but if demanded from the top by for example the employer or from the political level. It is stressed by some countries that thorough

implementation is important, meaning an organizational structure to support implementation, ownership among employees (especially older generations must be encouraged), introduction of solutions and time for training, access to support.

Italy mentions that digital solutions have been introduced as pilot projects without removing analogue/paper practices thus creating double work and negative attitudes. They also mention that the full potential of digital solutions is not used due to lack of connectivity between different solutions as well as due to the expectations of HPCs of what digital technologies can be used for (some have too narrow and some too broad use of solutions

4.2 LIMITATIONS OF THE STUDY

The study has several limitations. Purposeful sampling has been adopted, therefore (a) the population of HCPs and HCMs involved may not be representative and selection bias may have occurred, (b) the different points of view and experiences of professional categories (i.e., nurses, physicians, etc.) may have not been equally explored. The data collected provide the specific perspectives of HCPs and HCMs and do not aim to represent those of the relative healthcare organization or country. The majority of the sample consists of nurses and very few physicians have been included. Some countries have recruited the majority of the respondents from the primary sector and others have recruited primarily from the secondary or tertiary sector.

Also, quantitative data was only collected in three of the four participating countries.

The data collection was performed during the outbreak of the COVID-19 pandemic, which has profoundly influenced healthcare delivery and digitization which on one hand lead to restricted availability of HCPs and HCMs but the other hand gave insight into the readiness of healthcare institutions for digital health.

5 DISCUSSION

In summary, consensus is evident for the potential of implementing new digital technologies in the healthcare sector. Likewise, everyone is in agreement on the importance of digital competencies, as it is seen as an enabling factor for a sustainable implementation.

The analysis of the quantitative sample of self-reported digital competencies shows that the strength and weaknesses are highly comparable across countries. The respondents from the Danish sample score is an inkling higher in average compared to Slovenia and Italy, but overall the differences are minor, especially considering the difference in healthcare system in general. The respondents are highly competent in areas of:

- User skills
- Data – information and security
- Communication & Dissemination

The areas are related to a traditional understanding of patient care & safety. For instance, if you are competent in the use of a device, communicating with patients, and safe patient data practice.

In the following areas, competencies are comparatively lower:

- Awareness
- Implementation
- Development

The areas are related to a mindset aimed at keeping up to date with emerging digital technologies, implementing them, and the awareness of ones shortcomings.

When looking solely on the professions, another pattern emerges. Healthcare managers are generally the most competent group followed by *others*, while *doctors* are the profession group with lowest digital competencies overall.

Nurses and physio- and occupational therapists are competent in user skills, communication and dissemination and data – information and security, while they lack competencies in development, implementation and awareness. These findings suggest that there is room for improvement in the HCPs digital competencies when it comes to Development, Implementation and Awareness.

This seems align with findings in Catalonia, where HPCs often do not acknowledge that they need training as they believe they know how to use the

digital solutions at work. They primarily associate digital competencies with knowing how to use digital tools – to have procedural skills and not the many other skills, such as communicating through technology etc. An area which they also score highly in as measured in the quantitative analysis.

Curiosity and the interest and willingness to work with and get acquainted with new solutions is crucial. Employees must dare to embark on digital technologies. If you have the will and the interest you will acquire the necessary competencies." (Denmark)

The qualitative analysis indicates that one of the key enablers is open-mindedness, interest, curiosity, patience and courage, but looking at the quantitative analysis, it seems that these are the areas where the respondents are weakest. Therefore, if digital competencies are to fully support the digitization of the healthcare system, a change of mind-set and ways of thinking is required.

Another interesting result in the quantitative analysis demonstrates that respondents generally have high scores on communication and dissemination. The interviews with HCPs and HCMs indicate a call for further training within these areas, the old saying that what is known is only the tip of the iceberg, the rest is hidden beneath sea level. This could be because communication is considered a key competency for HCPs – in general, but in particular for nurses, who make up more than 80 % of the respondents in the quantitative sample.

An indication may be HCPs do not consider digital competencies related to the areas of awareness, implementation and development as a part of their professional identity. That seems to be the case if looking at their strengths i.e. how to use the digital devices, patients' rights and how to communicate with patients and colleagues. They score very high on competencies closely related to what has normally been considered the "professional domain" of HCPs. Being able to communicate with and guide patients by using different kinds of digital devices, and lastly awareness of patient rights are closely related to classic professional domain competencies and as such, easily adapted into digital context.

6 CONCLUSION

First and foremost, the research report set out to explore the current level of digital competencies among HCP and HCMs in the partner countries. Achieving a mixed method research design came about in a coalition between the partner countries and their respective reference groups. In preparation, a literature review was undertaken[5]. Based on the literature review, it was decided to also include the mind-set and attitude of HCPs and HCMs related to digitization in the examination. Therefore, answers to the research questions are very broad in order to inform the complex task of designing training material in digital competencies for HCPs and HPMs working in clinical practice.

The research report succeeded in studying the level and type of digital competencies HCPs need to provide high quality healthcare through mixed method research design with collection of data from four different countries with almost 500 respondents in total. The self-assessed digital competence level of HCPs and HCMs appear very similar across countries and among professionals. HCPs and HCMs generally assess to have high user competencies, competencies for communicating and disseminating and competencies related to data security.

Lowest competencies are in the areas of implementation and development of digital solutions and awareness of own shortcomings. HCMs assess themselves higher than HCPs in these last three areas. Having a positive mindset and attitude towards digitization is considered the most important 'competency' and enabler. This is reflected in the interviews in all four countries.

As stated earlier, the potentials in digital technologies are great and also viable. However, the journey towards a digitized healthcare system is far from easy. The route is paved with obstacles and bottlenecks, where the lack of structured training and education on digital competencies plays a major role.

One of the main findings of this report is, that the HCPs experience inadequate training both in terms of lack of allocated time and resources. This can lead to frustration and hinder a sustainable implementation of the digital technology. Therefore, it is highly relevant that the need for a structured approach to training digital competencies is addressed.

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[5] The findings will be published in a scientific journal, not published yet.

This research report succeeded in creating a sound empirical foundation on which the educational material in IO3 can be based. The main conclusion in regard to the development of the educational material is clear: There is a need to focus on mind-set and attitude towards digital solutions as well as a request for better training and abilities to practice. The role of management and organization plays a crucial role in facilitating WHY digital technologies make sense and to create better conditions for getting to know new technologies and to reflect about daily use. Training is paramount in order to see and acknowledge their value.

Especially in Italy and Slovenia, HCPs and HCMs also request better digital tools and infrastructure, improved IT support as well as better implementation of digital technologies. HCPs also express a need for higher skills for using existing digital solutions and to some extent, call for skills for digital communication as well as more technical understanding.

This research has shown that the above-mentioned are the important factors for health care professionals to feel competent and to be able to work efficiently in a more digitized health care sector.

The collected data has been analyzed, presented and discussed among the DELIVER partners and reference groups in order to determine the DELIVER project's direction and next steps in developing educational material.

Main conclusions of the qualitative research related to **research question 3:** *Review existing national and international knowledge, strategies, guidelines and best practices relating to training or education initiatives of HCPs in preparation and implementation of the digital health transformation:*

- Results are described in a scientific publication, therefore not included in this document.

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