DELIVER

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RESEARCH REPORT IO2: ORGANISATIONAL ANALYSIS

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CONTENT

1 INTRODUCTION

We live in a digital world, however digitization of large systems is a major challenge due to their complexity. Health care systems are complex and very important for each society, therefore their digitization is a rather slow process. Literature review shows that the health care industry is way behind other industries in adopting digital technology, even though there have been rapid advances in big data and data analytics. The health care industry has adopted the first two generations of technology changes with ease but is finding it difficult to adopt the third and the fourth level of digitization due to several factors (*https://www.riseba.lv/sites/default/files/inline-files/jbm_09.02_2016_11_2.pdf#page=126*).

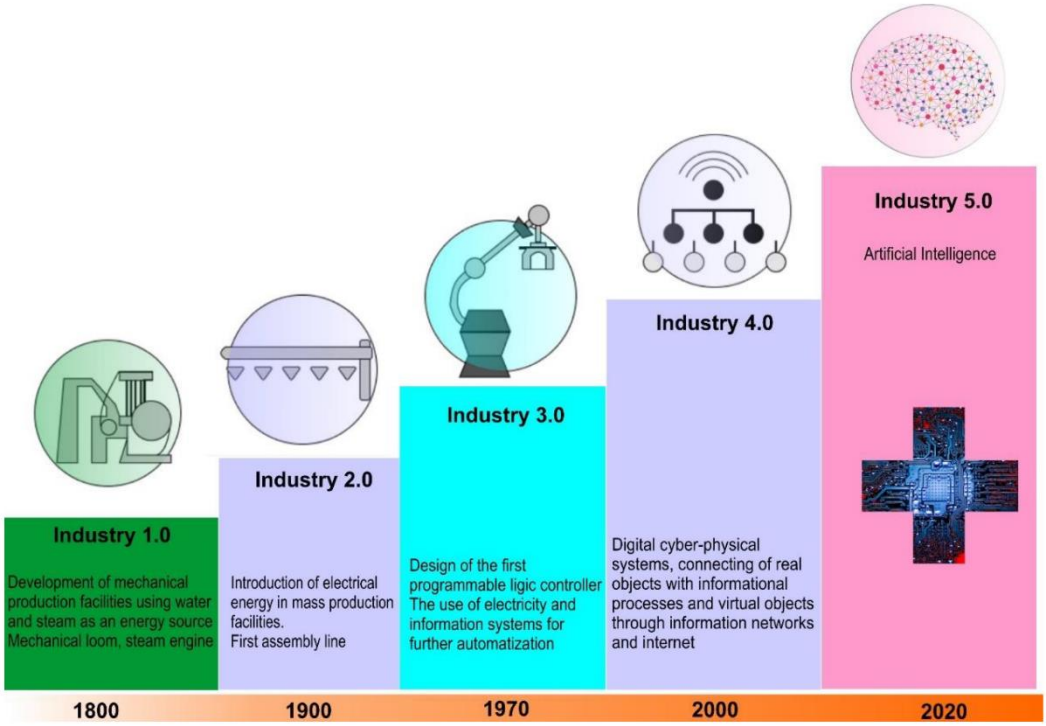

Figure 1: Evolution of industrial developments over time. (source: https://www.mdpi.com/1996-1944/15/6/2140/htm)

There have been rapid advances in the last few decades in health care informatics – electronic health record systems, genomics, remote diagnostics, wireless technologies, wearables, context-aware computing and cellular technologies that are changing the scene of the health care industry (https://www.riseba.lv/sites/default/files/inline-files/jbm_09.02_2016_11_2.pdf#page=126). Big data and data analytics are expected to change the health care delivery system if adopted. The

convergence of these technologies may result in a health care delivery system far ahead of customer expectations.

The Fourth Industrial Revolution, otherwise known as Industry 4.0, is advancing healthcare to unprecedented comfort levels on the foundation of digitisation, artificial intelligence, and 5G telecommunication. In this context, Table 1 summarises various definitions used currently in the context of Industry 4.0 to explain many of its subsystems.

Table 1: Definitions of critical elements in an Industry 4.0 system.

Name	Alternative Term	Definition
Internet of Things	Industrial Internet of Things; IoT; IIoT	A single device or a system of devices having network access and communication with information networks and the internet.
Artificial intelligence	AI; Deep Learning; Machine Learning	AI is a collective term for computer systems that can perceive their environment, think, learn, and can take action in response to stimuli or pre-assigned goals.
Neural networks	Artificial Neural Network; ANN	A mathematical model or computing system, as well as its software or hardware implementation, built on the principle of organization and functioning of biological neural networks—networks of neurons of a living organism.
Blockchain	Cryptographic ledger	A continuous chain of blocks containing all the records of transactions and safe distribution among participants.
Additive manufacturing	Digital manufacturing; 3D Printing	The process of manufacturing parts, which is based on the creation of a three-dimensional physical object from a digital geometric model, by adding material in a layer-by-layer manner.
Advanced materials	Composites; High Entropy Alloys; Hybrid materials	New groups of materials which are out of standard classification—metals/alloys, ceramics, polymers.

Name	Alternative Term	Definition
Radio-frequency identification	RFID	A communication system that stands for radio frequency identification method. This is a method whose task is to recognize living or inanimate objects using radio waves. Fingerprints, retinas, voice, or clothing are used as Auto-ID.
Big data analytics	Big data; BDA	This technology deals with a large array of data, enabling the derivation information relevant for rapid decision making
Digital medicine	Digitalisation in medicine; Hospital 4.0 H-IoT	The collective term for Industry 4.0 technologies used in medicine.
Virtual & augmented reality (including medical application)	VR & AR	Perceived mixed reality created with the help of a computer using “augmented” (visual/audio) elements of perceived reality, when real objects are projected in the field of perception.
Virtual and VR Experiments	VE & VRE	Virtual experiments and experiments with body part surrogates.

Source: *https://www.mdpi.com/1996-1944/15/6/2140/htm*

Countries face different digitization levels of their health care systems due to different contextual factors. The DELIVER project involves four different countries into an organisational analysis: Denmark, Italy, Spain and Slovenia to explore levels of digitization in their health care systems.

2 BACKGROUND

Digitalisation in healthcare is a global trend due to various factors:

1) The rise of on-demand healthcare (slowly and in line with higher mobility of the patients); majority of patients own smartphones and search online for medical and healthcare information;
2) Big data in healthcare can provide (if properly aggregated and managed) lower rate of medical errors; identify frequent visitors of emergency rooms and provide them preventive care to keep them from returning; more accurate staffing due to better predictions of future admission rates;
3) Virtual reality is a new and cheaper treatment than drugs;
4) The growth of wearable medical devices (like Heart rate sensor, exercise tracker, sweat meters, ect);
5) predicting what illnesses and diseases will become major problems in the near future;
6) rise of artificial intelligence;
7) blockchain in healthcare (an effective tool in preventing data breaches, improving the accuracy of medical records, and cutting costs. (https://www.digitalauthority.me/resources/state-of-digital-transformation-healthcare/)

Nevertheless digitization process in healthcare needs to be approved and encouraged on the national as well as organisational level. All four partner countries have support for this process on the national level – they have established programs for Digital Health: The Danish Digital Health strategy (national, renewed every four years); The Italian National Recovery and Resilience Plan (July 2021) has a dedicated part about the digitalization of the health care system; the Slovenian National Program eHealth; in Spain the current Health Plan 2021-2025 contains a specific area focused on digital transformation. Focus of all these programs is similar: to modernise healthcare system, enhance health digital skills of citizens and professionals; strengthen the technological infrastructure and tools for data collection, processing, analysis and simulation; efficiently manage complex data and information about health, as well as reduce administrative costs; offer effective and user-friendly digital solutions for patients, health care providers and managers.

3 ORGANISATIONAL ANALYSIS IN DELIVER PROJECT

3.1 PROJECT PARTNERS AND STAKEHOLDERS IN ORGANISATIONAL ANALYSIS

There are four partner institutions involved in the project:

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

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

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

All project partners have been represented at a transnational meeting relating to the need analysis and organizational analysis and through a workshop they have identified the factors to be explored in carrying out the need analysis and organisational analysis. The partners have reviewed and provided feedback relating the developed digital questionnaire and interview guide to health care professionals, health planners and health care managers as well as relating to literature study methods.

Through a mixed method approach including both quantitative survey and qualitative individual and focus group interviews all partners have collected data for the organizational analysis.

Key stakeholders in each country were:

- Health care managers (HCM) of health care institutions on primary, secondary and tertiary health level;
- Health care professionals (HCP): doctors (medical profession) on all health care levels, nurses, physiotherapists, and other;

- ICT specialists;
- and also: health care planners, educational institutions, local communities.

3.2 RESEARCH SCOPE AND GOALS, RESEARCH QUESTIONS

Project aims at conducting studies on levels of digitization and organizational factors to understand the digital health systems and infrastructure that promotes and allows for the full integration of digital health solutions and HCPs digital skills training.

Output of organisational analysis (IO2) is assessment of the level of digitization and technical support currently available in each country and categorization and description of the overarching factors that HCPs and HCMs need to have in place to ensure the advancement of digital health and the implementation of digital skills educational programs for HCPs.

The need analysis (IO1) and organizational analysis (IO2) provide information towards the development of a transnational educational program, which is the aim of intellectual output 3: Educational program and e-learning tools.

Additionally the results will contribute to intellectual output 4; Development of a digital platform for knowledge sharing and to intellectual output 5; Policy and implementations recommendations providing empirical information, best practice and calls for future actions/initiatives.

Research questions of organisational analysis (IO2):

Conducting studies on levels of digitization and organizational factors to understand the digital health systems and infrastructure that promotes and allows for the full integration of digital health solutions and HCPs digital skills training:

- Level of digitization: What is the level of digital infrastructure (internet, software, platforms, data centres etc.), in each partner country and the type of digital solutions (telemedicine, m-health, e-health, etc.), used to provide health care delivery in the hospital and community setting?

- Organizational factors: What are general attitudes of the institution towards digitization? Do healthcare professional feel supported by organisation using digital technologies? What is the strategy of digitalisation? What are the organisational factors that pose barriers or facilitates the digital transformation of health? Analysis of digital health strategies, organisational structure, leadership, workplace culture, and workflows.

3.3 RESEARCH METHODOLOGY

3.3.1 Data collection methods and techniques

Data on organizational factors has been collected with a mixed method approach with a purposely-designed digital questionnaire for IT specialists and qualitative individual and focus group interviews. All partners have also reviewed existing knowledge, strategies and initiatives relating to training or educational initiatives of HCPs related to the digital transformation in order to identify potential gaps and opportunities to align standards. Table 3 shows different data collection methods related to different research questions.

Table 3: Data collection methods related to different research questions

Problem statement/ aim of analysis	**Research questions**	**Methodological approach/ Research methods**
IO#2		
Conducting studies on levels of digitization and organizational factors to understand the digital health systems and infrastructure that promotes and allows for the full integration of digital health solutions and HCPs digital skills training	What is the level of digital infrastructure (internet, software, platforms, data centres etc.), in each partner country?	Qualitative interviews/focus groups with HCPs and HCMs Survey among ICT specialists Literature review/desk research
	Which type of digital solutions (telemedicine, m-health, e-health, etc.) are used to provide health care delivery in	Qualitative interviews/focus groups with HCPs and HCMs Survey among ICT specialists

	the hospital and community setting?	Literature review/desk research
	Knowledge of the digital infrastructure which is important to understand the digital opportunities at local level and when incorporating the local context in designing the educational program's flexibility component.	Qualitative interviews/focus groups with HCPs and HCMs Survey among ICT specialists Literature review/desk research
	What are the organisational factors that pose barriers or facilitates the digital transformation of health? Analysis of digital health strategies, organisational structure, leadership, workplace culture, and workflows.	Qualitative interviews/focus groups with HCPs and HCMs Literature review/desk research
	Which are the areas where adjustments are required to ensure local anchorage, implementation and sustainability of the educational program?	Qualitative interviews/focus groups with HCPs and HCMs Literature review/desk research
	Do the HCMs have the tools to support successful implementation of digital infrastructure and technologies, and how do they support the enhancement the digital skills of HCPs?	Qualitative interviews/focus groups with HCPs and HCMs

1.1.1 Data analysis methods

The collected data has been analysed and and discussed between the partners and reference groups in order to determine the digital literacy and skills gap, which will then determine the projects direction.
Quantitative and qualitative data have been considered as complementary – therefore a mixed-methods analysis has been performed in order to combine them and to gain a comprehensive picture reflecting the complexity of the phenomenon under study.

3.4 DESCRIPTION OF SAMPLE

3.4.1.1 Description of qualitative sample for interviews and focus groups

A total of 74 HCPs and HCMs from all four countries have been included in the qualitative study.

HCPs and HCMs 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.*"

In every partner country there has been conducted qualitative interviews and/or focus groups with between 11 and 25 respondents with the following professions: Nurses, midwifes, therapists (physiotherapists/ occupational therapists), physicians/doctors, psychologists, health care managers with personnel responsibility over HCP's and other health care managers (human resource managers, general service managers and managers responsible for education/training of HCP´s).
Only HCPs with authorization from the partner countries respective competent authorities have been included in the study.

The following sectors/institutions have been included in the study:

- Primary sector: Municipalities, Community Health Care Centres, elderly care, private practitioners/ private health care providers
- Secondary/tertiary sector: Public hospitals – general (secondary) to highly specialized (tertiary) (and private if relevant in country)
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In Italy 4 focus groups were conducted with 25 participants:

- 6 managers: 4 nurse managers in various hospitals, 1 physician manager (Hospital, Accreditation, clinical risk management and health performance evaluation) and 1 ICT manager (Central Directorate for Health, Social Policies and Disability, Regional Health Information Systems Service);
- 8 nurses: 4 from various hospitals, 3 from Universities and 1 nurse executive from Regional Health Coordination Agency, Department of Clinical Governance
- 2 hospital physicians
- 1 hospital Quality processes coordinator and 1 sociologist in hospital Quality Accreditation
- 1 social and care coordinator (Nursing home)
- 1 educator in the Continuing Education Centre (PhD, Nurse).

In Catalonia 11 participants were included in a qualitative research:

- 5 managers on various levels of health care, 2 of them were nurses in a managerial role
- 4 nurses
- 1 physician
- 1 pharmacist

In Denmark 20 participants from hospitals and municipalities were individually interviewed:

- 5 managers
- 2 doctors/physicians
- 2 dietitians
- 4 nurses and 1 midwife
- 3 physiotherapists
- 1 occupational therapist
- 2 psychologists

In Slovenia 18 respondents participated in qualitative research – some in smaller focus groups and some in individual interviews. Qualitative study was conducted in autumn and winter 2021, so online meetings had to take into account Covid situation and workload of HCPs and HCMs. Slovenian participants were:

- 5 nurses: 2 from primary health care level (1 Community health centre and 1 home for elderly), 1 from general hospital – secondary level and 2 from tertiary health care level;
- 7 physiotherapists: 4 from Community health care centre, 1 from general hospital – secondary level and 2 from tertiary health care level;

- 1 general physician from Community health care centre;
- 5 representatives of middle or higher management in health care: 1 from Community healthcare centre, 1 from general hospital – secondary level and 3 from tertiary health care level.

3.4.1.2 Survey IT specialists IO2

Short quantitative research was sent to IT specialists on various health care levels. In Slovenia 4 IT specialists were involved: 2 from general hospitals on secondary health level and 2 from tertiary hospitals.
In Denmark 2 IT specialist were involved.
Please add: Catalonia, Italy

3.4.2 Data processing methods

Focus groups and interviews were conducted by all four partners in their native language. They were all recorded so that transcripts could be written. Separate focus groups were conducted among different stakeholders, namely: nurses, managers, physicians. Sometimes physiotherapists and other health care workers formed separate focus group. Separate conclusions were drawn from managers (HCM) and from professionals (HCP): physicians, nurses, physiotherapists, etc.

Gathered materials (transcripts) were organised around key research questions related to IO2, which included:

- General attitudes of the institution towards digitization
- Organizational equipment/readiness for the adoption of digital technologies
- The organization is equipped/prepared for the adoption of digital technologies
- Feeling supported by the organization in using digital technologies
- Strategy for digitization
- Top three barriers to successful implementation of digital health in the unit/department
- Top three enablers to successful implementation of digital health in the unit/department

Analysis of qualitative data followed these topics. 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 and quotes were translated to English and sent to other project partners.

Quantitative research was short and was sent only to IT specialists on national level, primary and secondary health care level/organisations. Short questionnaire aimed to get information on hardware infrastructure used in organisation to support clinical and non-clinical tasks (internet, software, platforms, data centres, etc.). We were also interested in kinds of software and software tools used in organization to support service management delivery (telemedicine, m-health, e-health, etc). Answers to open-ended questions were gathered in each country, organised and translated to English.

1. LIMITATIONS OF THE STUDY

All conclusions were drawn from personal opinions and experiences of the HCP and HCM. They don't provide the whole picture but specific perspective of their health care organisation. There were different HCPs involved in each country: many nurses but not so many physicians. They have different experiences and not every aspect and perspective was included due to the limitations of the study.

Research was conducted in pandemic of Covid-19. There were restrictions in availability of certain HCPs and HCMs. On the other hand pandemic gave insight into the readiness of health care institutions for digital health

4 RESULTS

4.1 Qualitative organisational analysis IO2

General attitudes of the institution towards digitization (HCP)

Overall attitude of the management towards digitalisation in health care institution is positive (Denmark), however it is not always a priority: sometimes support is only verbal where only implemented solutions are used without further development (Slovenia). In many organisations, there are difficulties due to budgets, the difficulty of replacing old computers and providing new tools and work programmes to meet the needs of HCPs. Many workers, especially older ones, often find it difficult to use the computers and programmes and are not given support by experienced staff. Another concern of HCPs is confidentiality and privacy of the data, which need to be taken care of and well communicated. Despite the need to invest, the health care institutions have not increased the number and the qualifications of the staff devoted to digitization transformation (Italy). Pandemic brought different dynamic of work and more HCPs tried to digitize their work processes (Catalonia). One HCP said that *this strategic line "has not been seriously issued until the beginning of the pandemic, which has forced many organizations to digitize in record time".*

"We're a bit limited because we're always looking for availability. We always have that problem of the budget not being exceeded, and so in order to give more potential, a wider spectrum, we limit ourselves on technology. So instead of having the latest generation, we stop at the generation a little earlier because it allows us to have two more machines than the latest technology" (Italy).

"In particular, I don't know whether everyone is doing it. So it is not required or that someone has control over it to make sure everyone is doing it. It often happens that only a part of people is working diligently on it, while others don't." (Slovenia)

Equipment of the organisation for the adoption of digital technologies (HCP)

In Catalonia and Denmark health care institutions are well equipped with digital technology (hardware and software); problems are lack of time for proper training and resources for implementation (Denmark).

In Slovenia and Italy situation depends on the sector: private health care facilities are far better equipped than public; inside public sector some departments are well

digitalised: Covid-19 departments in Slovenia, oncology or neurosurgery in Italy. The rest of the departments are faced with lack of equipment or old equipment and not updated in the software.

In Slovenia some remote Community Health Centres face poor internet connection; bigger health care institutions have problems getting IT help after regular working hours (afternoons, nights).

"So if something goes down after five o'clock, it's dealt with the next day, or there might be an IT guy on duty to come up with a workaround or not" (Slovenia);

" We have two computers at our disposal. Two computers. Of these two, one is ready to be written off and when it dies it dies. The one we have in the clinic is used by five people and we have to input all the services we provide every day and fill out everything and this computer broke down six months ago." (Physiotherapists, Slovenia)

"In the Hospital I work for, the technology is absolutely obsolete for most of the PCs and, moreover, the Hospital's PCs are absolutely inconsistent with the needs of colleagues. In the sense that it depends a bit on the Hospital hierarchy, so if you're a manager and you're more fortunate and you have a computer if you're a nurse and maybe you want to do some research you don't have a computer at all" (Italy).

"There are often problems in the implementation of new solutions. For example with this video-system. We were told to use it. And then there was a long period, where we had to find out how to use it, where to use it and who was in charge. And then it fell to the ground. Because there was no one that kept it alive." (Denmark).

Managerial view on the equipment of the organisation for the adoption of digital technologies (HCM)

HCMs in Catalonia and Denmark believe that organizations are well-equipped with desktop computers and wired Internet access everywhere. In Catalonia one aspect to improve is Wi-Fi connectivity, which is restricted due to security concerns.

In Slovenia and Italy private healthcare facilities are much better equipped with digital technology than public. There are still many public facilities with old technology and a lack of staff to support HCPs in the use of new technology and programs. There is a need to develop a new way of thinking to allow digital transformation of the institutions. In Slovenia lack of hardware in public institutions leads to duplication of work (paper and digital documents). In Italy strategies used to offer education and training are not consistent with the expected competencies.

"Then, there's the equipment itself, we don't have these PDAs or tablets, or whatever; in fact you can't go to the patient and take their case history and then input it directly. You always need paper ... So we use this to a lesser extent because it absolutely duplicates our work." / "We also have very poor hmm… computer support from our IT professionals ... all they do is repair computers." (Slovenia)

"Courses are designed and delivered to develop different competencies,not that expected" / " Some members of the staff is at risk to be excluded: may we accept this?" / "up-dates are not performed on a regular basis - therefore the systems available are not accessible" (Italy)

HCPs' perception of being supported by the organization in using digital technologies (HCP)

In Catalonia and Denmark HCPs feel supported by their organization in the use of digital tools. Italy and Slovenia mentioned problems with training for new technologies. In Slovenia training is provided for existing employees when new software/system is deployed; training for software already in use is carried out by colleagues who are already using the software - employees provide knowledge transfer to new employees. Because software is provided by external partners later adaptations and improvements are hard to implement. In Italy the organisation often drops instructions and implementation of new programmes from above without providing adequate training, or there is a lack of new equipment and technology. As a result, many HCPs do not feel prepared or supported to use the technologies, or they cannot have new equipment and computers.

They are very responsive to new initiatives that can help in our daily lives and make it easier. However, there are financial challenges (Denmark).

"The employer is already in favour of change. But most of the time the problem is the software itself.... it's the software developer's responsibility. And that's a big expense. So ideas for improvements come up all the time, but usually the answer is that the change is too big and that this would entail changing the entire software product, which is not something done by our institution but by the software developer in charge of the institution. Then these things we want to do sometimes take a year. In the meantime, something else comes up or the thing itself already becomes obsolete" / "For me personally, the problem is that different institutions use different systems or information systems and they are not connected." / "However, it was not structured or systematic training. That's what's missing in my opinion or in my experience" (Slovenia).

"Health care professionals need more integrated and ergonomic systems to perceive themselves supported.. of course, they need to acquire competencies but on the other, they need to be more supported" (Italy)

Strategy for digitization (HCM)

In Denmark there are strategies for digitization in hospital sector and in many municipalities, however they are not known by many HCP´s though. In Slovenia HCMs mostly stress that digitisation is a priority and they focus on paperless operations.

In Catalonia, it would seem that HCMs do not know about the digitalization strategy of their organizations because their work area is not within the scope of digital transformation. Only one manager, a digital transformation responsible, said that they were working in a strategic plan for their institution.

In Italy there is not unified strategy for digitalisation. It is important to promote light digitization processes, accompanying HCPs to change their practice. Moreover, in each unit, there is a need to have a professional who has this attitude and who is available to help others. Digital systems should be intuitive, not complex (similar to Mobile phone solutions). There is also a need to change the educational support given: manuals are ineffective while on-the-job support or mentoring, the opportunity to see short videos are more effective.

“Yes, for Community Health Centre Ljubljana, I can easily say that digitisation as such and investing in IT support is a high priority for us." / "we want to go paperless within a year ... that's one of the management's demands and that's what we're aiming for ... we're already buying devices." (Slovenia)

"We need to overcome the dualisms between digital and paper, digital and analogic..." / " ..it does not have to be heavy, it does not have to be something that weighs you down but something that lightens you and that you like and that gives you something." / "It must also be accompanied by a support of a specialized type, that is, we cannot be left to ourselves in using it" (Italy)

BARRIERS / FACILITATORS

Top tree barriers to successful implementation of digital health in the unit/dpt (HCP)

Barriers related to citizens are lack of technological understanding and digital skills among patients/citizens, as well as lack of interest in digital solutions among patients/citizens when there are physical alternatives. Family doctor in Slovenia stressed that older people are not skilled in using digital services - as a consequence, health care is less accessible to them. There is however motivation at the national level to accelerate digitisation.

Barriers related to HCP are: resistance to change, lack of training, and lack of equipment. In Slovenia some software is unified, some software solutions are different in each institution. Physiotherapists in Slovenia mentioned most barriers because their work is not digitalised – this profession was left behind in all three health care sectors: unfair allocation of resources across units in the institution

(according to profession); refusal to comply with superiors' wishes - superiors have an inhibitory approach; employees do not talk to management about their wishes/ideas; there is no real communication with superiors and developers, some employees' refusal to digitise is tolerated.

In Italy barriers are: 1) the physical provision of IT support (e.g. having computers available, having an effective internet connection, and appropriate allocation of the resources); 2) lack of time to learn to use programmes and new technologies properly; 3) lack of training to make the best use of the programmes and devices provided; 4) lack of proper educators.

In Denmark organizational barriers relate to lack of resources due to lack of staff (especially nurses) and poor implementation (when it is dictated from above what to do; when all employees are given the responsibility for using and implementing systems rather than appointing a responsible; lack of time for implementation and training; testing phase is missing; lack of organizational changes that would enable to profit from the potentials of new digital solutions). Technical barriers relate to "immature" systems (inflexible structures and rules) and unsustainable systems. Also resistance to change and lack of digital skills can be found with HCPs and HCMs.

»If you say to the citizen, go up in the browser, copy and paste it here. They have no idea what the browser is. It's a huge problem.« / »There can be a lot of resistance when organizations are already under pressure.« / »If a system does not fit in with the workflows and procedures where it is to be used and thereby makes things more complicated and does not create any value. This reinforces the employees' anxiety about a new system.« (Denmark).

"The change must be immediate…..there is no time for training, for accompanying this change" / "There is a huge turnover of the staff in the last two years due to the pandemic and this have threatened our competencies" (Italy)

"As for the high costs, if something has to be implemented for the very first time, it is a significant financial burden" / "Institutions are highly heterogeneous. We use six different software programs just for community nursing. For a country as small as Slovenia. And the institutions are not interested in doing this, not everybody is going to make a change and it's not just installing software. You need to make sure that everything works, you have to train everyone, it's a really big step" / "I'm sure it's just about the lack of interest of management so we don't have it; nobody is pushing it forward ... Second, there is the equipment, definitely. Third, it's people." / "I think it's probably also about the government, which is responding kind of slowly. I would expect them to speed things up by saying, 'We'll give you everything, we'll give you equipment and we'll train you, we'll give you everything you need but in the end you have to achieve this goal we set for ourselves." (Slovenia)

Managerial view on the top tree barriers to successful implementation of digital health in the unit/department (HCM)

HCMs in Denmark have the same view on barriers to successful implementation of digitization as HCPs. In Slovenia barriers to successful implementation of digital health in the unit/department are: lack of unified digital solutions at the national level; lack of knowledge/inability to use digital technologies, resistance to digitisation by senior managers/staff; but also patients who do not use technology. Catalonian HCMs' most often mentioned barriers are: the reluctance to change and the lack of time for training. Other barriers have also been mentioned, such as the lack of homogenization in the use of tools and practices between the different centres or the limitations in the current technological infrastructures.

Top three barriers in Italy: outdated structure of the available information systems (reflecting outdated methods and logic); lack of systematic planning and organisation to facilitate the transition of health institutions to the digitisation; lack of training to make the best use of the programmes and devices provided.

"The transition to digital technology was left somewhat to chance and therefore perhaps not included in programmes, training and organisational plans" (Italy)

One HCM thinks that "even in the youngest professionals you can find resistance to change because they adapt quickly to the way we traditionally work." / "We need to find a common language between the organizations to ensure a homogeneous and effective management of data and processes." (Catalonia)

"But I would absolutely like the government to help us here and to guide us. The government should find the experts who will create the best and the most optimal system.« / "Senior leadership does not accept digitisation" / "We already know that probably a third of patients will never use it, because they don't use email either and will continue to use the phone to sort things out." (Slovenia)

Top three enablers to successful implementation of digital health in the unit/department (HCP)

All project partners stress the importance of usefulness, easy to use, and organization's digital culture. More detailed description of enablers in Slovenia: deployment/implementation of tablets for real-time data entry; motivation of people; cooperation between all levels of healthcare; ideas, suggestions and solutions from staff; funding secured; appropriate presentation of digitisation to staff - benefits, appropriate computer equipment for work secured; appropriate training provided. The COVID-19 epidemic has accelerated digitisation.

<u>Italian HCPs described top three enablers as:</u>
1) The use of very fast technologies for certain procedures, like digital signatures through the use of mobile phones. There is a need to develop portable devices

allowing HCPs to be at the bedside, to use them easily and to access them at each moment.
2) To have trained and dedicated staff who can train professionals in the use of software and new programmes and can intervene if necessary.
3) The development of simple, intuitive programmes with attractive interfaces, built around the needs of professionals. Moreover to have efficient wireless systems, working in a safe manner to protect patients' data.
All of the abovementioned strategies require an approach at the system level, integrating the health care facility with those at the regional and at the national level. There is also a need for foreign HCPs to access to digital devices in their own language.

Also HCPs in Denmark stressed the importance of organisational digital culture where HCMs see digital technology as priority, share confidence in digital transition and allocate enough resources (time, money, IT help). They also emphasise simple, user-friendly, easily accessible technical equipment that is continuously updated. There needs to be clear purpose of digital technology for the HCPs and patients. Sufficient time for training and time and opportunity to try out and become confident with new technology is very important. Good role models who train/teach colleagues when new technologies are introduced are of vital importance.

»If others say 'I don't usually do that. I do not use it, so you don´t have to either', new technology will never be implemented.« / »Some need to have solutions demonstrated. Some need to see is on screen. There is such a big difference in how people learn. One has to give different choices for learning.« (Denmark)

"As a facilitating factor technology, especially touchless technology. Think how our hospitals have changed with touchless badges" / " The time.. " / " a link between the unit and the ICT staff - with a HCPs able to develop a connection" (Italy)

"Even the presentation of digitisation ... it seems to me that when we hear digitisation, we think it will be more work and more problems, and maybe many people are afraid of one of these things and are against it on a priori basis. Although once you explain it to them, once you show them the benefits, tell them how it's going to work, everyone accepts in the end and we learn these things." / »Yes, indeed, I would have liked to see us introduce tablets so that we could go from room to room and enter all the activities on the fly." (Slovenia)

Managerial view on the top three enablers to successful implementation of digital health in the unit/department (HCM)

In Denmark HCMs share the same view as HCPs. In Slovenia HCMs mostly talked about their interest in digitalisation, more than about enablers, which are: expressed interest in training by employees; they would like to have young mentors/tutors when it comes to the use of advanced technologies.

In Catalonia different factors have been discussed: technological (useful and easy-to-use tools) and organizational (the digital culture of the organization is a key to the implementation of technology).

Most important enablers by Italian HCMs are:

1) Trained and dedicated staff who can train professionals in the use of software and new programmes and can intervene if necessary;
2) Time to learn how to use new technologies (that this time has to be formally recognised);
   3) regional or national planning that promotes the digitisation;
3) Reducing workloads of the specialised ICT staff or improving their availability for HCPs;
4) There is also a need to differentiate the hard digital skills and the soft digital skills: the first are easily learnt, the second require more time, strategic thinking and support
5) There are two main strategies: appropriate hard and soft equipment and support.
   Moreover, HCMs should learn how to protect themselves to be always connected and also how to protect their staff from the burden due to excessive connection and digitization

“This is possible with good leadership, which works the fears and reluctance to change of professionals. (…) In addition to leadership, we need enough budget and also professionals who are experts in digital transformation” / “Sometimes, I find that there is a lot of dedication in the backend development in the project, while in the end, the key is to develop an easy-to-use, comfortable, practical and useful tool” (Catalonia).

"The fact of having the support of a person who can somehow help you when you are in difficulty is definitely a facilitating factor because it allows you to move forward and enhances the tool you are using." (Italy)

"It would be wiser to have good ... mentors or good ... tutors who are young or have strong digital skills to advise us" (Slovenia)

4.2 Quantitative organisational analysis (Survey IT specialists IO2)

DIGITAL INFRASTRUCTURE described by ICT specialists

Type of hardware infrastructure used in organization to support clinical and non-clinical tasks (internet, software, platforms, data centres etc.)

All health care organisations use personal computers, laptops, printers/scanners and telephones. Internet connection is generally good except in some rural areas.

In Slovenia most of them also have: smartphones, cisco switch (LAN), Optic Fiber network (WAN and LAN), Wifi (LAN), landlines (telephones, Fax). Four included institutions don't have Mobile network (MPLS Simcard). Both involved Community Health Centres have Patched network (LAN), one of them has Checkpoint Firewall. Some institutions have company tablets.

In Denmark data is stored in datacentres owned by the Region of Southern Denmark. The region also has agreements with private companies where they host and store the data e.g. Microsoft Cloud and similar solutions. The five regions of Denmark also collaborate about data storage in a national partnership where private companies are used. They also collaborate on standardizing the IT-platform for telemedicine and all the communication standards.

Kinds of software and software tools used in organization to support service management delivery

In Slovenia institutions use Microsoft Office, local Healthcare system, Government provided Health Care databases and systems. Local healthcare systems in Community Healthcare Centres are: ISOZ21, LABIS, SAOP, Hipokrat, Labis, Audax Impulz; whereas in hospitals they have Medis (hospital information system), Prolis (pharmacy inf.system), laboratory information system (order laboratory research, sharing results) and radiological inf.system. Government provided databases and systems are: e-referral, e-recipe, CRPP, eRCO, e-triage, IPPO, zNet. Among Web-services (miscellaneous integrations for data sharing between the above mentioned) internet sites of the Ministry of Health and Ministry of Labour were mentioned. Additional software mentioned by ICT specialists were: Kadris - record keeping on attendance at work; the same provides also Špica, d.o.o.; there is a software for calculating salaries and human resource management; erp business information system dynamics nav.

In Denmark tools and software used for communication in hospitals are: Cisco Webex (internal meetings and teaching), MitSygehus (patient communication); and in municipalities: Microsoft Teams (internal meetings and teaching), Skype for business, Zoom, Adobe Connect, Cisco (Facebook communities). Tools and software used for journaling/documentation/registration in hospitals are: Cosmic (soon EPJ Syd), specific clinical systems, Office tools (Word, Excel, PPT, Outlook), databases. In municipalities thy use: KMD Nexus, KMD Nova (personnel folders and citizen-related), Novo-link, Novax (correspondence with general practice and hospitals), Mediconnect, Office tools, especially Outlook, Excel. Other widely used systems are: Voice recognition, simultaneous interpreter, Google Maps, HR systems (shift schedules, vacation schedules, sick leave etc.), e-learning systems,

apps for patients and practitioners, robot technology (AI) for registration, VR-glasses, Sharepoint.

Since 2007, Fundació TIC Salut Social has been carrying out an annual study, so-called Trends Map Report, to quantitatively determine the degree of implementation and use of ICT in all public healthcare providers (SISCAT) in Catalonia. The Trends Map Report, has become a reference study for the health and social sector as provides a real picture of the situation and evolution of ICT in the network of Catalan centers. Initially, it was exclusively focused in the ICT situation of healthcare providers, latterly, as the level of digitalization in the healthcare sector is adequate, a similar study is being carried out in social services.

The last survey focused in health information systems was carried out through an online survey which it was specifically designed to be answered by the healthcare providers' Chief Information Officer (CIOs). It was launched in September 2018 and data was collected until November 2018. The survey covered several areas including software and hardware being used, interoperability, cloud computing, security, mHealth, model of governance, digital transformation, human resources in IT department, exponentials technologies, and sustainability among other interesting topics.

The Chief Information Officer (CIOs) from 105 healthcare providers answered the survey which represents approximately 90% of the total healthcare providers. The respondents covered the representation of healthcare services and levels from Primary and community care, Specialized and hospital acute care, Socio-health care, Mental health care and addictions. The results of the survey were published in a report in 2019 .

This kind of activity should be considered as a good practice to be implemented elsewhere as it maps the current situation in the implementation of ICT and it can help to detect needs and gaps to the governments.

5 DISCUSSION

6 CONCLUSION

Main conclusions of the qualitative research related to **research question 1: Organisational readiness for digitization, including strategies for digitization and equipment/organisational structures for adaption of digital technologies:**

- **Digital strategy** is in place but not every HCP and HCM is familiar with it, since it is not in their scope of responsibilities
- **There is not unified strategy to digitalisation:**
  - different scope of obligatory digital tools in different countries and in different levels of health care (primary, secundary, tertiary)
  - Not every digital solution is developped on the national level: sometimes health care organisations are left to themselves to develop an appropriate digital tool
- **Organisational readiness for digitalisation depends on**
  - **The country**: in Denmark and Catalonia health care institutions are better equipped with digital technology than in Slovenia and Italy;
  - **The sector:** in Italy and Slovenia private health care facilities are far better equipped than public
  - **The department**: inside public sector some departments are better digitalised than others: Covid-19 departments (Slovenia), oncology or neurosurgery (Italy). The rest of the departments are faced with lack of equipment or old equipment and not updated in the software.
  - **The mindset**
  - **Implementation strategy**

"We need to overcome the dualisms between digital and paper, digital and analogic..." / " ..it does not have to be heavy, it does not have to be something that weighs you down but something that lightens you and that you like and that gives you something." / "It must also be accompanied by a support of a specialized type, that is, we cannot be left to ourselves in using it"
Italy

Main conclusions of the qualitative research related to **research question 2:Organisational attitude towards digitization and management support in using digital technologies:**

- **Overall attitude** of the management towards digitalisation in health care institution is **positive**.
- In many organisations, there are **difficulties due to budgets** (the difficulty of replacing old computers and providing new tools and work programmes to meet the needs of HCPs).
- Many workers, especially older ones, often find it difficult to use the computers and programmes and are not given support by experienced staff.

- **Confidentiality** and privacy of the data is a big concern of HPCs.
- **Pandemic** brought different dynamic of work and sped up some digitalisation processes in health care institutuions that would otherwise take more time
- **Staff problems** to implement digital transformnation (number of people and their qualifications) in some countries: Italy, Slovenia

"The employer is already in favour of change. But most of the time the problem is the software itself.... it's the software developer's responsibility. And that's a big expense. So ideas for improvements come up all the time, but usually the answer is that the change is too big and that this would entail changing the entire software product, which is not something done by our institution but by the software developer in charge of the institution. Then these things we want to do sometimes take a year. In the meantime, something else comes up or the thing itself already becomes obsolete"
Slovenia

Main conclusions of the qualitative research related to **research question 3: Description of organizational factors that pose barriers and facilitators to the digitization and implementation of educational programme:**

Key barriers:
- resistance to change
- lack of digital skills (often by senior staff, sometimes by HCM)
- lack of training
- lack of equipment and other resources (nurses, educators, etc)

But also:
- patients' inability to use digital technology (older patients, primary level);
- lack of unified digital solutions at the national level;
- Different digital support for different HC professions (hierarchy)
- Laack of sistematic planing and organisation of the digital transformation
- outdated structure of the available information systems (reflecting outdated methods and logic) in Italy

- immature” systems (inflexible structures and rules)

Key facilitators:

- usefulness, easy to use,
- organization’s digital culture,
- sufficient time for training and time and opportunity to try out and become confident with new technology

Keep in mind the importance of:

- easily accessible technical equipment that is continuously updated;
- the development of simple, intuitive programmes with attractive interfaces, built around the needs of professionals;
- implementation of tablets for real-time data entry;
- Organisation‘s digital culture: HCMs put priority to digital technology, share confidence in digital transition and allocate enough resources (time, money, IT help);
- motivation of people; cooperation between all levels of healthcare

7 LITERATURE

https://www.digitalauthority.me/resources/state-of-digital-transformation-healthcare/

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