Computer and Information Literacy in Nursing as a Prerequisite for Financial Sustainability

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Abstract

This paper examines information technology and information literacy of employees as one of the more essential prerequisites for creating smart hospitals, which are, on the other hand, a prerequisite for sustainable financial operations. Since nursing is the backbone of every hospital, research is focused on the nursing profession. Namely, if medical personnel do not know the basics of information and communication technology (ICT) and are incapable of recognizing, finding and structuring information into new knowledge and exchanging it with colleagues, an intelligent hospital is impossible, and the business is worse. For this reason, research was conducted to determine the state of computer and information literacy in the nursing field in hospitals in north-western Croatia. It was carried out in 2021, which determined the ratio of administrative work and health care and examined the level of ICT knowledge of nurses and technicians. Analysing the secondary, higher and higher medical school curriculum determined the current situation and required improvements. The research results showed that computer and information literate staff spend less time on administration; they estimate that there is not enough content on computer literacy in the existing curricula. The hospital's operations will also be efficient because the competencies of the nurses will enable better implementation of business processes and a better financial result for the hospital.

Keywords: computer literacy; information literacy; curriculum; smart hospital; nursing

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Introduction

The concept of a smart hospital (Božić, 2019) has developed over the past ten years. It implies a highly technologically developed hospital using the latest information and communication technology (ICT), including the Internet of Things (IoT), Big Data, Artificial Intelligence (AI) and Cloud Computing. A smart hospital aims to speed up and improve business processes and increase the efficiency of healthcare staff in treating patients. In a smart hospital, patients access information more quickly and communicate with healthcare professionals more efficiently. Computer and information literacy of employees and patients is the basic prerequisite for smart hospitals, enabling employees to use modern ICT more effectively and efficiently. Therefore, our subject of interest is nurses' computer and information literacy (in this paper, the term nurse refers to medical nurses and technicians equally) (Marković, 2021). The paper aims to research and determine the current computer and information literacy level in the regulated nursing profession in north-western Croatian general hospitals. The paper also aims to determine the level of study on computer literacy provided in formal education and through lifelong learning. Furthermore, attention is given to the knowledge, skills, and competence required of nurses to become more time-efficient in their administrative work with the help of computer and information literacy. In this way, they would have more time available for health care. Based on the research question about the importance of computer and information literacy in nurses' jobs, the paper tries to confirm the following research propositions (RP):

- RP1. Computer and information literacy helps nurses improve health care quality by reducing the time spent on administrative tasks.
- RP2. Modernized content must be incorporated into the current nursing curricula and study programmes to increase computer and information literacy and enable lifelong learning.

Several methods have been used to confirm the stated research propositions, such as studying and analyzing the available literature, researching information literacy standards, conducting a survey on meeting the information literacy standards, and self-assessment of information literacy. A brief overview of the field is provided, followed by a description of the research and results, a discussion, and a conclusion.

Methodology

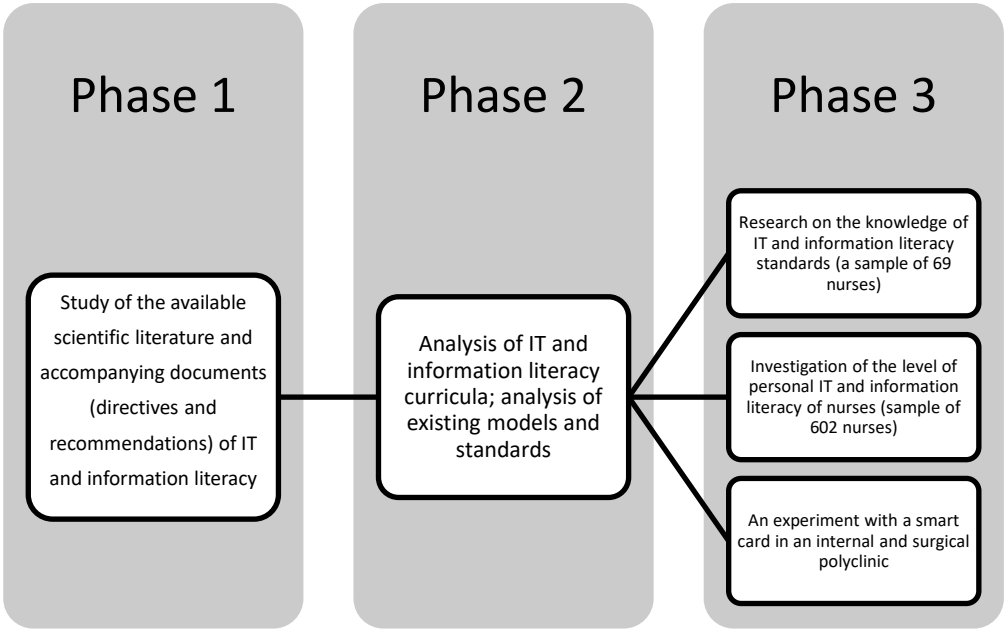
The paper's research subject is the computer and information literacy of nurses in general hospitals in north-western Croatia as a prerequisite for a smart hospital. Information literacy was coined at the end of the 20th century, sparking researchers' interest. Various authors define information literacy as recognizing, finding, analyzing, and effectively using key information to make proper decisions. Papers in the field of computer and information literacy investigate (i) general computer literacy (Eisenberg, 2008), (ii) information literacy in librarianship, (iii) the connection of information and

computer literacy (Lasić-Lazić et al., 2012), McDougall, 2018; De Meulemeester, 2018; Shaw et al., 2018); and (iv) the necessity to study information literacy in education (Hoffman, 2020). Many papers discuss computer and information literacy indirectly, but they are essential for paper topics (Boilson et al., 2019; Hunady et al., 2022; Kovačić et al., 2022; Osvaldić, 2021; Peterlin et al., 2020; Pejić Bach et al., 2019; Roblek et al., 2018).

Numerous papers discuss computer and information literacy from the perspectives of students, professors, librarians, nurses, and doctors and the influence of ICT development on promoting computer and information literacy. However, there is insufficient research on computer and information literacy in health-regulated professions, especially in nursing. In the paper's continuation, the research results carried out in the general hospitals of north-western Croatia are presented.

Figure 1

Research phases



Source: Author's work

The research included several elements:

1. The analysis of computer and information literacy-related topics defined key concepts, basic occurrences and correlations (Abunadi, 2018; ACRL, 2013; Australian and New Zealand Information Literacy Institute Adelaide, 2004).

2. Curricular analysis was conducted to determine the extent of computer and information literacy-related content. This also provided an overview of the formal

computer and information literacy of graduates entering the labour market (European Commission 2005, 2013; Croatian Chamber of Nurses, 2022; Domitrović, 2016).

3. A survey on information literacy models and standards was conducted (ACRL, 2013; Australia and New Zealand Information Literacy Institute, 2004). A survey questionnaire was designed to assess knowledge and skills based on the self-assessment of medical nurses and technicians. This was necessary in order to examine nursing as a regulated profession and the related scientific field and then propose mandatory curricular content and professional development programmes in the field of computer and information literacy (Abunadi, 2018; ACRL, 2013; Australian and New Zealand Information Literacy Institute Adelaide, 2004; Croatian Chamber of Nurses, 2022, Domitrović, 2016; Lloyd, 2010; Špiranec et al., 2018).

Three research have been conducted. The first survey was conducted to investigate information literacy standards in nursing. The sample includes 69 nurses (ward nurses and their substitutes). The analysis aims to examine the ability to define the need for information, the ability to effectively collect the necessary information, to choose research methods and apply search strategies, the ability to critically evaluate information and information sources, the effectiveness of using the information to achieve goals, and the ability of the medical nurse/technician to understand ethical, legal, and socio-economic issues related to computer and information technology.

The second survey was conducted on a sample of nurses about their IT and information literacy levels. The sample included 602 nurses (254 with secondary education, 194 with post-secondary education and 114 respondents with university-level education). The analysis aims to define nurses' computer and information literacy through research on computer and information literacy regarding age, level of education, job complexity, and self-assessment of ICT knowledge.

The third research was used as the observation and measurement. The sample includes internal medicine and surgery polyclinic nurses. The experiment was conducted in such a way that a certain clinic works for one week without the use of a smart card, and the second week, the same clinic works with a smart card; variables that are observed and measured: number of patients, patient enrolment time, patient processing time (for the same incoming diagnosis) and number of patients performed per unit of time. The goal of observations and measurements is to prove that ICT speeds up the work process and reduces administration; observation and measurement are carried out on three separate occasions (continuously for three months - each month, one week's work is performed without card readers and cards, and one week with card readers and cards); observation and measurement include the same variables (employee, computer, number of patients, patient diagnosis and type of referral); the only change is working with or without smart card reader and smart card.

Results

Analysis of the survey on information literacy standards in nursing

There are no established information literacy standards in nursing in the Republic of Croatia, so the Information Literacy Standards developed by the Association of Higher Education and Research Libraries (ACRL) - "Working Group for Information Literacy Standards for Nursing" were used for the questionnaire (ACRL, 2013). The survey questions aimed to examine the ability to define the need for information, the ability to effectively collect the necessary information (S1), the selection of research methods and the application of search strategies (S2), the ability to critically evaluate information and information sources (S3), the effectiveness of using the information to achieve goals (S4) and the medical nurse's/technician's understanding of ethical, legal and socio-economic issues related to computer and information technology (S5).

The goal of the survey was to determine which standards of computer and information literacy nurses are met and to what extent. The criteria for meeting these standards were defined by the ACRL (2013).

The survey was completed by 69 respondents (nurses). The structure of respondents according to professional qualifications: 31 respondents with finished secondary education, 25 with finished post-secondary education and 13 with finished university education. Each standard contains questions: S1-31, S2-29, S3-39, S4-20, and S5-15. The share of positive answers out of the total number of answers was observed. Only two of the five standards are partially fulfilled. Table 1 demonstrates that respondents partially meet two groups of standards, while all other groups do not. These results emphasize the need to examine the computer and information literacy levels in nursing.

Table 1. Standards partially met (n=69)

Standard	Standard fulfilment (%)	Information literacy level
S1 (the ability to define the need for information)	41.27	partial
S4 (the effectiveness of using information to achieve goals)	38.71	partial

Note: Criteria for determining literacy: 0 - 33% insufficient; 34 – 66% partial; 57 – 100% satisfactory; *Source: Author's work*

Analysis of the survey on computer and information literacy

According to the established criteria in nursing, the research results on computer and information literacy justify the intention to define nurses' computer and information literacy in more detail. Further computer and information literacy research should be conducted regarding age, level of education, job complexity and self-assessment of ICT

knowledge. The research was conducted online in four general hospitals in north-western Croatia. Medical nurses and technicians with secondary, post-secondary and university-level education participated in the survey, with 602 completed surveys collected (sample size). The respondents' structure according to the education level was secondary education 254, post-secondary education 194 and university-level education 114 respondents.

The answers to the questions relevant to the research propositions will be emphasized. A high percentage of 45.7% of respondents completely disagree, partially disagree or are indifferent, which shows the need for computer or information literacy (Table 2).

Table 2. Respondents' distribution regarding the ratio of computer use and administrative tasks concerning healthcare

If you use the computer, do you spend too much time on administration compared to health care?	% (N=602)
Completely disagree or partially disagree	46.10
Neutral	16.27
Completely agree or partially agree	37.63

Source: Author's work

Table 3 contains respondents' satisfaction with knowledge acquired through formal education. The answers show that the respondents are against introducing new curricula but support improving the existing ones by adding content on computer and information literacy and ICT knowledge in general. The respondents' answers also suggest the necessity of lifelong education in computer and information literacy.

Table 3. Satisfaction with knowledge acquired through formal education

Respondents' attitude	Completely agree (%)
Would additional education, improved computer use, and ICT training benefit your daily work performance?	64.10
Is continuous and lifelong education necessary to increase the ICT knowledge needed for your work performance?	80.70
Is it necessary to introduce additional (new) ICT courses or increase the teaching load (number of course hours) in vocational and higher education to the level sufficient for your work performance?	42.00
Is it necessary to improve the ICT curricula in vocational and higher education to a level sufficient for your work performance?	77.20
Are the computer use and ICT knowledge you acquired through formal vocational high school and/or higher education sufficient for your work performance?	44.90

Source: Author's work

Analysis according to age

Look at the significance value of the positive impact of IKT-a according to age groups. You can see that the Kruskal-Wallis test indicates a statistically significant difference concerning the age of the respondents. Table 4 displays the highest ranks (the highest indicator of value) for respondents aged 40-49 and 50+ (the highest positive influence).

Table 4. Comparison of respondents' attitudes towards the positive impact of ICTs by age group

Factor	Age group	N	Arithmetic mean rank
Positive impact of ICTs	20-29	188	**311.73**
	30-39	178	**301.51**
	40-49	115	**349.99**
	50 and above	120	**236.48**
	Total	601	
Kruskal-Wallis H	26.638		
df	3		
Asymp. Sig.	**0.000*** **		

*Note: *** statistically significant at 1% probability; Source: Author's work*

The significance value of post hoc testing (Table 5) shows a significant difference in the 50+ age group when compared with other observed age groups ($p<0.05$).

Table 5 Post-hoc test comparing respondents' attitudes towards the positive impact of ICTs by age group

Relation by age groups	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
50+ vs. 30-39	65.031	20.433	3.183	0.001	**0.009*** **
50+ vs. 20-29	75.243	20.213	3.722	0.000	**0.001*** **
50+ vs. 40-49	113.508	22.575	5.028	0.000	**0.000*** **
30-39 vs. 20-29	10.212	18.092	0.564	0.572	**1.000**
30-39 vs. 40-49	-48.477	20.697	-2.342	0.019	**0.115**
20-29 vs. 40-49	**-38.265**	**20.480**	**-1.868**	**0.062**	**0.370**

*Note: *** statistically significant at 1% probability; Source: Author's work's work*

Analysis according to level of education

Suppose the value of significance for the positive influence of ICTs is observed according to educational level. In that case, it can be seen that the Kruskal-Wallis test indicates a statistically significant difference with regard to the respondents' education level. At the same time, it can be seen in Table 6 that the ranks are the highest (the highest indicator of value) for university-level educated respondents.

Table 6 Comparison of respondents' attitudes towards the positive impact of ICTs according to level of education

Factor	Level of education	N	Arithmetic mean rank
Positive impact of ICTs	secondary	293	**251.76**
	post-secondary	194	**330.32**
	university degree	114	**377.65**
	total	601	
Kruskal-Wallis H	51.689		
df	2		
Asymp. Sig.	**0.000*** **		

*Note: *** statistically significant at 1% probability; Source: Author's work's work*

Suppose the significance value of the post hoc testing is observed (Table 7). In that case, there is a significant difference in the secondary education level compared to post-secondary and university levels ($p<0.05$), but no difference was observed between respondents with post-secondary education and university degrees.

Table 7 Post-hoc analysis of respondents' attitudes towards the positive impact of ICTs according to level of education

Relation by level of education	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
secondary vs. post-secondary	-78.559	16.013	-4.906	0.000	**0.000*** **
secondary vs. university degree	-125.886	19.096	-6.592	0.000	**0.000*** **
post-secondary vs. university degree	**-47.327**	**20.415**	**-2.318**	**0.020**	**0.061*** **

*Note: *** statistically significant at 1% probability; Source: Author's work's work*

Analysis according to job complexity self-assessment

Look at the data in Table 8. You can see that the significance of the Kruskal-Wallis test is more than 5% for the p*ositive impact of ICTs* ($p>0.05$), so it can be concluded that there is no significant difference between the responses of respondents considering the self-assessment of the complexity of the job. The difference was not statistically significant, so there was no post-hoc analysis.

Table 8 Comparison of respondents' attitudes towards the positive impact of ICTs according to job complexity

Factor	Job complexity self-assessment	N	Arithmetic mean rank
Positive impact of ICTs	Low	5	**295.70**
	Medium	287	**292.66**
	High	309	**308.83**
	Total	601	
Kruskal-Wallis H	1.306		
df	2		
Asymp. Sig.	**0.521**		

Source: Author's work

Analysis according to computer knowledge self-assessment

Observing at the significant value of the positive impact of ICTs, one can see a statistically significant difference concerning how one evaluates their IT knowledge, determined by the Kruskal-Wallis test. Simultaneously, it can be seen in Table 9 that the ranks are the highest (the highest value of the indicator) for respondents who self-assess their computer knowledge as above average.

Table 9 Comparison of respondents' attitudes towards the positive impact of ICTs according to computer knowledge self-assessment

Factor	Computer knowledge self-assessment	N	Arithmetic mean rank
Positive impact of ICTs	below average	43	**202.86**
	average	477	**294.54**
	above average	81	**391.14**
	Total	601	
Kruskal-Wallis H	36.497		
df	2		
Asymp. Sig.	**0.000*** **		

*Note: *** statistically significant at 1% probability; Source: Author's work*

Post-hoc testing was used to determine the exact groups of statistically significant differences (Table 10).

Table 10 Post-hoc comparison of respondents' attitudes towards the positive impact of ICTs according to computer knowledge self-assessment

RELATIONS	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.
below average-average	-91.679	27.545	-3.328	0.001	**0.003*** **
below average-above average	-188.282	32.641	-5.768	0.000	**0.000*** **
average-above average	-96.602	20.790	-4.647	0.000	**0.000*** **

Source: Author's work

The positive impact of ICTs is most visible among respondents aged 40-49, with a university level of education, who self-assessed their job complexity as high, and among respondents who rated their computer knowledge as above average.

Experiments with smart-card reader

Nurses' work was precisely observed and measured while entering administrative data with and without smart cards (surgical polyclinic and internal medicine polyclinic). The research lasted three weeks to confirm the repeatability principle and eliminate the element of chance.

The observation and measurement goal is to prove that ICT application speeds up the work process and reduces administration. Observation and measurement were carried out on three occasions (continuously for three months - each month, one week's work is performed without card readers and smart cards, and one week with card readers and smart cards). Observation and measurement are designed so that all variables are the same (employee, computer, the number of patients, patient diagnosis and type of referral). The only change is working with or without a smart card reader and smart card. The clinic works for one week without using a smart card; the following week, that same clinic works with a smart card. Variables observed and measured include the number of patients, patient enrolment time, processing time (for the same referral diagnosis), and number of treated patients per unit of time.

Measurement results indicate that:

- patients spend less time in the clinic if the nurses use a smart card and the corresponding reader
- the number of treated patients per unit of time increases if a smart card and reader are used

Increased patient flow includes:

- More diagnostic and therapeutic procedures performed and paid for by the Croatian Health Insurance Fund (HZZO) - have a positive financial effect on the general hospital's operations.
- Increased patient satisfaction due to faster processing (less time at the reception desk and more time with the doctor).

Patients' medical findings are automatically sent to their general practitioners by applying ICT (due to smart cards), and patients do not need to return to the hospital to pick up their findings on paper.

Curricula analysis

The second research proposition was confirmed by analysing international and national directives (guidelines, frameworks) that are a prerequisite for defining specific curricula. A specific curricular proposal for improving the level of information literacy was defined. The criteria for evaluating the quality of curricula in secondary, post-secondary and university education for medical nurses/technicians are as follows:

- ECDL – European Computer Driving Licence, that is, knowledge of office tools, email, and the Internet, essential for computer literacy,
- meeting information literacy standards (curricular analysis according to standards),
- adapting curricula following national directives (guidelines, frameworks),
- number of teaching hours in subjects referring to computer and information literacy concerning the total number of teaching hours (in all subjects).

The analysis of four secondary schools, four post-secondary qualification institutions and four universities of applied health sciences determined the following:

- In secondary and post-secondary educational institutions, there are subjects on computer literacy following the national guidelines,
- There are no guidelines for universities of applied health sciences. Therefore, specific curricula are not uniform,
- There is no information literacy-related content, or there are only partial elements of it at all three educational levels,
- Compared with Great Britain, Germany, Slovenia and Hungary, the students in the Republic of Croatia have the highest workload in hours; the structure is also different – there is more theory and less practical work.

Due to the lack of subjects on information literacy, the research analysis results emphasize introducing information literacy-related content into the educational system based on the ACRL standard (2013). There is no framework (guidelines, directives) for curricular development in computer and information literacy for the University of Applied Health Sciences. Therefore, this part aims to propose guidelines for information literacy. National guidelines for undergraduate studies in nursing can be used to develop guidelines for information literacy curricula in universities of applied health sciences. The proposal for an information literacy course in nursing is given below (Table 11).

Learning outcomes are based on Bloom's taxonomy. Information literacy curricula should ensure that nurses can meet the outcomes of the ACRL (2013).

Table 11 Proposal of information literacy curriculum in nursing

Course name:	**Information literacy in nursing**
Course goal and purpose:	Training pupils and students for independent learning and building knowledge with distributed information sources; ethical participation in learning and educational communities; and civil society.
Learning outcomes:	Upon completing the programme, pupils and students are expected to acquire the competence to independently access and browse information sources of analogue, digital and virtual origin in any form and format. Pupils and students should be able to find, process, evaluate, study, and manage relevant information. They need to analyse, critically evaluate, synthesize, organize, and interpret information and then present it to responsibly create new knowledge by studying for tests, writing essays, presenting and handing in seminars, final assignments and (under)graduate theses.
Skills needed for information literacy require understanding (general goals and purpose in the curriculum):	"need for information, knowledge of available resources, finding information, evaluating and processing results, ethical and responsible use of results, channels of communication and sharing results, and managing results" (Rašidović, B., 2019, p. 42) All of the above is taught through the following units: Browsing Information, Advanced Search, Organizing Information, Understanding Text, Using Information, Analysing and Creating Charts and Diagrams, Analysing and Creating Maps, Evaluating Information, Creating Structured Information, Usability, Copyright and Intellectual Property, Data Protection and Use of Social Networks.

Source: Author's work

Impact on the financial result

By observing the research propositions, it can be noted that computer and information literacy affect better financial results directly and indirectly by improving health care. Computer and information literacy can positively influence better financial results, described below.

Direct impact

- **It has improved operational efficiency.** Computer and information literacy enables better use of technological tools and software that facilitate business processes. Routine task automation, better data organization, and rapid information exchange can improve business efficiency. This can reduce costs, increase productivity, and make decision-making faster, leading to better financial results.

- **They improved decision-making.** Computer and information literacy improve data understanding and interpretation. Business data and analytics are important in making informed decisions. Computer and information-literate employees are better at analyzing data, identifying trends, recognizing problems and opportunities, and making better decisions. Quality decisions can optimize resources, reduce risks, and increase revenues.
- **Innovation and competitive advantage.** Computer and information literacy encourages business creativity and innovation. Employees with the necessary ICT skills can experiment with new ideas, apply new technologies and improve processes. Innovation can result in new products and services, increased value for customers and competitive advantage in the market, which increases financial results.
- **They improved data management and security.** Computer and information literacy includes understanding the importance of data protection and security practices. Good data management, ensuring privacy and protection against security threats, can prevent financial losses, reputational damage, and legal problems. Computer and information literate employees can actively participate in maintaining a safe and reliable information environment.

Indirect impact

Computer and information literacy enables nurses to perform administrative tasks more efficiently and have more time to provide better health care. Better health care can positively affect a hospital's financial results in several ways, as described below.

- **Enhanced reputation and trust.** High-quality patient care builds trust. Patients are more likely to choose that particular hospital for their medical needs, resulting in a growing number of patients and increased revenue.
- **Cost reduction.** Better health care results in fewer complications, reduced length of hospital stays, and fewer rehospitalizations. This can reduce treatment costs and increase hospital efficiency. Cost reduction can increase profits or investment opportunities to improve infrastructure, equipment, and staff training.
- **Increased employee satisfaction.** Quality health care requires well-trained and motivated staff. Employees doing their job well and having a positive work experience can reduce staff turnover and improve productivity and healthcare quality.
- **Better collaboration with insurance companies.** Insurance companies often negotiate with hospitals about the terms and prices of the care provided. If the hospital can prove high quality and positive treatment results, it gains a stronger negotiating position with insurance companies. This can lead to more favourable contracts and increase the hospital's income.
- In today's digital age, computer and information literacy are increasingly important for business success. As technology and data play an ever-increasing

role in all sectors, organizations whose employees are computer and information-literate often gain competitive advantages and achieve better financial results.

Discussion

In this part of the paper, the research propositions will be discussed, work limitations emphasized, further research recommendations made, and certain conclusions drawn.

The influence of nurses' computer and information literacy on improving health care quality by reducing the time spent on administrative tasks (RP1)

Through observations, measurements, and surveys, it was established that by increasing nurses' computer and information literacy, the level of health care could be improved by more efficient working time distribution between administrative tasks and providing health care. ICT (more precisely, the smart card reader and the smart card itself) speeds up the administration. That is, more patients are treated per unit of time. The smart card establishes a vertical connection between the hospital, the Croatian Health Insurance Fund (HZZO) and the Croatian Central Health Information System (CEZIH). General data on insured persons entering the hospital information system is automatically retrieved. In addition, by accessing the eReferral, referral data (type, diagnosis, referral number) is uploaded to the so-called patient case. Compared to manual registration, ICT applications speed up administration, allowing more time to provide health care to patients. The number of patients admitted with the help of smart cards and smart card readers has increased by 43% on average. Over time, the administration process with a smart card and smart card reader is shortened by an average of 2 minutes per patient, saving 30% of time in one hour. If the patient's total stay in the clinic (admission + medical examination) is observed, the share of administration without ICT makes up for 29.50% of the total time spent by the patient in the clinic. With ICT, the total time of administrative work spent per patient in the clinic drops to 22.96%. From an economic point of view, more patients are processed per unit of time, and more diagnostic and therapeutic procedures (DTP) are recorded and invoiced. Computers and employees' working hours are used more productively. The unit cost per patient is lower because the employee performs more work in the same unit of time (the nurse enrols more patients). Because the nurse has more time for health care, she can make better quality records of diagnostic and therapeutic procedures (DTP), used materials and nursing care data. ICT reduces the number of possible errors by simplifying operations (medicines and medical consumables are recorded correctly and completely). This has a positive financial effect on the hospital's work. In addition to observation and measurement, the answers from the self-assessment survey on computer and information literacy indicate that ICT helps nurses perform administrative tasks faster and more efficiently, allowing them more time for health care.

Curricula changes as a prerequisite for increasing the level of computer and information literacy in nursing (RP2)

The analysis of available curricula and educational programmes for nurses at different educational levels indicates a lack of specific thematic knowledge, skills, and competence in computer and information literacy. Analysis of EU guidelines, National guidelines of the Republic of Croatia and specific curricula in secondary schools, undergraduate and graduate studies emphasizes the lack of knowledge, skills and competence, thus confirming the second research proposition. Teaching programmes in information literacy should be introduced through one-subject or cross-subject teaching. Also, lifelong learning programmes could compensate for perceived deficiencies in established educational programmes, keeping up with the continuously ongoing changes in technology and digital competence.

Paper limitations and future research recommendations

There are two main paper limitations. The first is the self-assessment survey of nurses on computer and information literacy, conducted in four hospitals in north-western Croatia. Observation, measurement, and survey related to ACRL standards (2013) of information literacy were conducted in one hospital. The results would have been more representative if the sample had been larger, i.e., if the research had been conducted in at least 50% of general hospitals in the Republic of Croatia. The second limitation is related to the means of conducting the survey. Namely, verifying the respondents who participated in the survey is impossible.

These limitations were used to suggest further research recommendations. Most importantly, research should be repeated on a larger sample (at least 50% of general hospitals), resulting in a more representative sample and more reliable results. Subsequent research should investigate the reasons for insufficient information literacy in nursing education and the lack of literature on information literacy. New trends in computer and information literacy in hospitals should be investigated in more detail, more precisely, artificial intelligence in health care, the Internet of Things, Big Data, and Cloud Computing. Following the results obtained, it would be appropriate to discuss high-quality teaching programmes for the computer and information literacy of nurses, preparing them to work with new technologies.

Final considerations

In today's competitive economy, it is necessary to be IT and information literate. Anyone who wants to survive in the market and be effective and efficient in their work must know how to find, analyse, present, evaluate and use information that can help them achieve an advantage over the competition with the help of ICT. If the employees within the organization are IT and information literate, then the organization fulfils the basic

prerequisite of being smart. General hospitals in north-western Croatia that participated in the research strive to be smart hospitals, which implies a high degree of computerization, the use of ICT in all business processes both within the hospital and in processes towards other healthcare stakeholders (general practitioners, pharmacies, public health institutes, insurance companies, nursing homes, institutes for emergency medicine).

Research has shown that hospitals in north-western Croatia do not have enough IT and information literate nurses, and this is a big obstacle for them to becoming smart in the full sense. Namely, the researched hospitals have solid ICT, but the employees (nurses) do not have the knowledge to use their potential fully. Through the research, research assumptions were confirmed that nurses spend too much time on administration concerning health care and that they need better education in the field of IT and information literacy through formal education and lifelong learning. Computer and information literacy, either formally through the education system or lifelong education, is necessary because the integrated information hospital system, radiology system, laboratory system, business information system, internal web, Internet, and web services are used within the smart hospital. In all listed sources of information, they are presented as unstructured, semi-structured or structured. In addition to sources of information, in a smart hospital, many medical devices use sensors to record certain data about the health status of patients and send this data to information systems where the data is linked into meaningful information that assists the medical staff in providing health care.

On the other hand, patients have access to a large amount of information with the help of which they can better understand their illness and correct their behaviour following their condition. ICT in a smart hospital allows the patient to communicate with his doctor outside the hospital, in the sense that the doctor can monitor the patient's vital functions through the device he wears. The most visible segment of the smart hospital is the so-called eBusiness. The concepts of eReferrals, eRecipes, eFindings, and eOrdering have taken root in practice today, enabling more efficient health system operation. A smart hospital is impossible if its employees do not know the ICT they work with, i.e., if they are not IT and information literate. Subject literacies enable nurses to know how to find their way in a sea of information, to know how to find the desired information quickly, to know how to connect it to new knowledge, to know how to exchange collected information with colleagues and patients, i.e. to use ICT more effectively and to be an important factor in the implementation of effective economic business.

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