Migration Letters

Volume: 19, No: S5 (2022), pp. 910-920

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

The Relationship Between Healthcare Providers' Attitudes Towards The Use Of Computer And Their Informatics Competencies In Hospital Practice

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Abstract

Background: *Health informatics (HI) competency is a required core competency for high-quality care in digitally enabled healthcare environments. Given the increasing reliance on digital health in palliative care settings, it becomes crucial to evaluate the healthcare providers (HCPs) competency to ensure the seamless integration and effective utilization of digital health in their clinical practice. HI must be integrated into daily practice due to the growing complexity of the healthcare industry and the healthcare profession, which will positively affect their attitudes toward information technology.* ***Aim:*** *This study aimed to assess the relationship between HCPs' attitudes towards the use of computer and their informatics competencies in hospital practice.* ***Methods:*** *A descriptive, correlational design, all inpatient care units utilized at King Abdulaziz Hospital, KSA from January to March 2022. The study included a convenient sample of 300 HCPs from various departments. Researchers used the HCPs' computers and information technology questionnaire tool and the HCP informatics competencies questionnaire.* ***Results:*** *Most of the HCPs polled had negative attitudes toward health informatics, and the overall mean of the informatics competencies of the HCPs polled was unsatisfactory.* ***Conclusion:*** *There was a significant positive correlation between the study participants' attitudes towards the use of computer and their overall informatics competencies.* ***Recommendations:*** *Design an appropriate training program to help HCPs maintain familiarity with new information technologies, supporting hospitals with resources.*

Keywords: *Information technology, Informatics competencies, Attitude, Practice.*

Introduction:

The training of competent healthcare providers (HCPs) is one of the most complex challenges facing education [(1)]. One of the main competencies that are indispensable to practice quality medical care in the current healthcare field is the utilization of informatics [(2)]. The concept "health informatics" is the scientific field that deals with the resources, devices and formalized methods for optimizing the storage, retrieval and management of biomedical information for

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problem solving and decision-making [3]. Although the name “health informatics” only came into use around 1973, it is a discipline that is as old as healthcare itself. It was born the day a clinician first wrote down some impressions about a patient’s illness, and used these to learn how to treat the next patient [4].

According to the International Medical Informatics Association (IMIA), effective and appropriate use of information and communication technologies is an essential competency for all HCPs; this expectation requires that HCPs be trained, not as medical informaticians but as knowledgeable users of the health informatics technology tools. The IMIA has defined and promulgated a set of recommendations that emphasizes inclusion of content in all HCPs undergraduate curricula that enables healthcare professionals to ‘‘efficiently and responsibly use information processing methodology and information and communication technology” [5]. The detailed health informatics competencies for undergraduate level in HCPs` education are available in the published Recommendations of the IMIA on Education in Biomedical and Health Informatics, first revision [5].

This International Medical Informatics Association (IMIA) has expertise in the field of education and the IMIA Recommendations on Education in Biomedical and Health Informatics guide curricula development are usually evaluated by national accreditation committees and accredited by IMIA which is an accreditation agency [5]. HCPs often lack knowledge of the possibilities and limitations of systematically processing data, information and knowledge with the resulting impact on quality decision-making. In order to enhance their practices through better use of information resources, HCPs are often asked to use information technologies of which they have limited appreciation. However, for systematically processing data, information and knowledge in medicine and in healthcare, health care professionals who are well-trained in health informatics are needed [5].

Additionally, the health sector is constantly changing as new ways of treating diseases are found through research. Worldwide, information, communication, and technology have significantly impacted healthcare practice. A new and essential idea in the health care system is using information systems and technologies to improve the quality and safety of patient care [6]. HCPs must use information and communication technology daily in today's healthcare system. In many places, using a computer is now a job requirement. So, HCPs play a very important role as one of the largest providers of health services across the continuum of care, health promotion, and health care at different levels. Because HCPs are the main people who collect and use information about patients, the quality of the information they access has always been important for good nursing care [7].

Information technology (IT) is the creation, distribution, and use of information technology in health care to create, store, and manage health information [8]. According to the American Nursing Informatics Association, an informatics nurse uses nursing, computer science, and information science to collect, process, and manage data to provide nursing principles, clinical care, education, research, and nursing informatics (NI) is a tool for giving safe, high-quality care to patients. It does this by letting the organization turn data into valuable knowledge. This, in turn, makes healthcare services more efficient and effective, which is reflected in the organization's overall outcome [9]. HCPs can use technology to find, understand, organize, and evaluate information from different sources to help them make better decisions about patient care and solve problems [10].

Correspondingly, nursing informatics can lead to better care for patients. But it doesn't look like nursing informatics is making the changes hoped for in nursing services. This could be because nurses don't have the right skills or don't know enough about IT. Because of this, nurses need to know more about health information technology and management and more informatics training [11]. To be competent, you must combine your knowledge, skills, and

abilities, such as your values, attitudes, critical thinking, and the ability to make clinical decisions. Every nurse must know much about informatics to provide safe, high-quality care. In addition to promoting safe and high-quality nursing practice, ensuring the right thing is done, helping nursing grow as a profession, making nursing education better, and knowing one's limits [12]**.** "Nursing informatics competencies" (NIC) means "an acceptable level of knowledge, skills, and ability to do specific informatics tasks [12].

Also, nurses must have the necessary (NIC) knowledge, skills, and attitudes to advance in their education and be ready for their nursing jobs [13]. The attitudes of employees are a significant factor that will probably affect how well information technology is put into place. Negative attitudes make it harder for staff to accept and use information technology well. Nurses' attitudes toward its use primarily determine the adoption of a computerized system [13]. How users feel about computers is likely to directly affect how well computer systems are used in nursing practice. So, how nurses feel about using computers is very important. For using computers in healthcare, there needs to be objective and comparable information about how nurses feel about computer use and what makes them feel this way. The growth of hospital information systems has also greatly affected how nurses do their jobs [14, 15].

Attitudes are how nurses feel about doing something, either positively or negatively, and are critical to their career success. Attitudes can be expressed as feelings of liking or disliking using NI. The attitudes were assessed by asking nurses about their beliefs about the consequences of using [16]. Information technology can help HCPs work more efficiently while also benefiting patients and healthcare organizations, and it is becoming more common in the nursing workplace. Many nurses have little to know computer knowledge and skills concerning the applications used in their workplace. Improving information technology skills is one of the most important and urgent things that need to be done to grow nursing informatics as a field within nursing. Combining nursing and computer science can also help nurses get better at finding, collecting, and managing data and information in all areas of nursing, such as clinical practice, education, management, and research. This prompted the current study to assess the relationship between HCPs' attitudes toward computer use and their informatics competencies in hospital practice.

Methods:

A descriptive, correlational design, all inpatient care units utilized at King Abdulaziz Hospital, KSA from January to March 2022. The research was performed in the inpatient care units of King Abdulaziz Hospital. When data was gathered, 300 staff nurses from different departments in the setting agreed to participate in the study and were recruited. In the sample, male and female staff nurses had worked in the study setting for at least a year. **Thompson (2012) [17]** equation was used to calculate the sample size, which included the following parameters: population size (1200), probability (50 percent), Z at 95 percent confidence level (1.96), and error proportion d. (0.05).

Tools for Data Collection: There were two data collection tools used: **First tool:** HCPs Computers and Information Technology Questionnaire (NCITQ) adopted from **Joseph et al., (2019) [14]**, **Watson & Carberry (2021)** [18]. It consists of two parts: **Part one:** Information about Socio-demographic characteristics as; age, gender, marital status, education level and years of nursing experience. **Part two:** A 5-point Likert scale was used to determine how nurses felt about using computers. It has 20 items, such as the use of information technology will lower the cost of health care, the use of information technology has led to the loss of nursing jobs in health care organizations, and so on. On a five-point Likert scale from 1 for (strongly disagree) to 5 for (strongly agree), the answers were given a grade (strongly agree). Scores on a scale were added up and put into two groups: positive (≥85%) and negative

(< 85%).

Second tool: The investigators created the HCP Informatics Competencies Questionnaire after reviewing related literature [19, 20]. It consisted of three sections with 47 items, as follows: Section I: Basic computer skills contained 17 items, such as "I have basic computer skills," "I can turn on and off my computer," "I can solve common computer problems," "I know how to use the Internet safely" ...etc. Section II: HCPs' informatics knowledge (15 items), such as "I know how to use the file management functions in PC operating systems, and I am able to describe the information needed for nursing among other key terms and concepts, etc. Section III: Informatics skills of HCPs (15 items), such as "I am able to collect data and information related to clinical care, and I am able to use HIS in the nursing profession, such as nursing records." A four-point Likert scale from 1 (very little) to 3 (very much) was used to rate. Scores on a scale were added up and put into two groups: satisfactory (≥65%) and unsatisfactory (< 65%).

The face validity of the study tools was tested by five experts in administration specialist for clarity, applicability, and adequacy. Minor modifications were done based on their opinions. Tool reliability: Cronbach's alpha coefficient was used to test the tools in this study. The HCPs Computers and Information Technology Questionnaire had a value of 0.7633, and the HCPs Informatics Competencies Questionnaire had a value of 0.745, which was a good score for reliability. Thirty HCPs participated in a pilot study (ten percent of the sample size). The aim of the pilot study was to make sure that the translated tools were precise, identify potential obstacles and problems during data collection, and estimate the time required to complete the questionnaires. As a result of the pilot study's findings, some items were modified.

We obtained permission to conduct this study from the director of Hospital. The researchers met with study participants at their workplaces who were available and willing to participate. The aim and nature of the research were then clarified to facilitate data collection. After consulting with the HCPs' schedule, this was done in both the morning and afternoon shifts. Each participant took about 30 minutes to complete the questionnaire sheets. It was returned the following day. The data collection process lasted three months, from January to March 2022.

Each participant provided oral informed consent after being informed about the study's aim and procedures. They were told they could say no or quit at any time and that any information they gave would be kept private. The way the study was done couldn't hurt the people who took part. Statistical Analysis**:** Using the SPSS version 28, the collected data were looked at in terms of frequencies and percentages for categorical variables. The means and standard deviations were used for variables that were always the same. The Pearson correlation coefficient was used to figure out how the study variables were related to each other. Chi-square tests were used for correlating categorical variables. High significance at $p < 0.01$** and slight significance at $p<0.05$*.

Results

Table (1) shows the social and demographic details of the study participants. More than two-thirds (69%) of the nurses studied were female. Regarding age, roughly two-thirds of the nurses studied (62 percent) were between the ages of 25 and 30 years, with a mean age of 28.98(3.68). More than half of them had a bachelor's degree in nursing, were married, and had less than five years of experience (54.7 percent, 59 percent, and 58.3 percent, respectively). Regarding computer access, most studied nurses had computers at home and work (81.7% and 59%, respectively). About two-thirds of the nurses who were studied (60%) had training in basic computer skills.

Table (2) illustrates the means, standard deviations, and correlation matrix between

study variables. The overall mean of the studied nurses' attitudes was 76.54 ±11.37, with a mean percentage of 72.9%, meaning that most of the studied nurses had negative attitudes toward nursing informatics. The overall mean of the studied nurses' informatics competencies was (98.56 ± 23.89) with a mean percentage of 52.42%, indicating unsatisfactory informatics competencies. Regarding informatics competencies sub-dimensions, the mean scores for basic computer skills, informatics skills, and informatics knowledge were (35.67± 6.98, 29.83± 5.43, and 32.78± 4.97), respectively, which indicated unsatisfactory levels in all dimensions. Concerning the relationships between the study's variables, there was a significant positive correlation (r = 0.614, P = 0.000) between the nurses' attitudes to computer use and their overall nursing informatics competencies.

Table (3) shows how the nurses who were studied were spread out in terms of their skills and feelings about nursing informatics. Three-quarters of the studied nurses (75%) reported negative attitudes toward nursing informatics. Almost two-thirds of the nurses studied (63.3%) reported unsatisfactory overall nursing informatics competencies.

Table (4) shows the relationship between the studied nurses' attitudes, overall informatics competencies, and socio-demographic characteristics. Gender (P=0.000), age (P=0.000), marital status (P=0.000), experience (P=0.000), having a computer at home (P=0.000), having a computer at work (P=0.024), and training (P = 0.000) were all associated with positive attitudes among the nurses studied. There were also significant relationships between the overall informatics competencies of the nurses studied and their gender (P=0.000), age (P=0.000), marital status (P=0.000), experience (P=0.000), having a computer at home (P=0.000), having a computer at work (P=0.000), and training (P=0.000).

Table (1): Frequency distribution of studied nurses regarding their socio-demographic characteristics (n=300)

Socio-Demographic Characteristics	**N**	**%**
Gender		
- Male	93	31
- Female	207	69
Age		
- < 25 yrs.	39	13
- 25<30 yrs.	186	62
- 30<35	45	15
- ≥ 35 yrs.	30	10
Mean±SD	28.98±3.68	
Marital Status		
- Married	177	59
- Unmarried	123	41
Education		
- Diploma in Nursing	79	26.3
- Bachelor in Nursing	164	54.7
- Graduate Studied	57	19
Experience		
- < 5 yrs.	175	58.3
- 5<10 yrs.	90	30
- ≥ 10 yrs.	35	11.7
Mean±SD	4.67±1.39	

Socio-Demographic Characteristics	N	%
Having Computer at Home		
- Yes	245	81.7
- No	55	18.3
Having Computer at Work		
- Yes	177	59
- No	123	41
Training		
- Yes	180	60
- No	120	40
Source of Training		
- Personal	107	35.6
- Work	63	21
- Study	10	3.4

Table (2): Mean, standard deviations and correlation matrix between study variables (n=300)

No.	Variables		1	2	3	4	5	Max	Mean ± SD (Mean %)
1	Attitudes	r						105	76.54±11.37 (72.9)
		P-value							
2	Basic Computer Skills	r	0.655					68	35.67±6.98 (52.5)
		P-value	0.000**						
3	Informatics Skills	r	0.432	0.322				60	29.83±5.43 (49.7)
		P-value	0.000**	0.022*					
4	Informatics Knowledge	r	0.592	0.489	0.644			60	32.78±4.97 (54.6)
		P-value	0.000**	0.005**	0.000**				
5	Overall Competencies	r	0.614	0.591	0.449	0.327		188	98.56±23.89 (52.42)
		P-value	0.000**	0.000**	0.000**	0.023*			

Table (3): Frequency distribution of studied nurses regarding informatics competencies and attitudes toward computer use (n=300)

No	Variables		N	%
1	Attitudes to computer use	Positive	75	25
		Negative	225	75
2	Basic Computer Skills	Satisfactory	109	36.3
		Unsatisfactory	191	63.7
3	Informatics Skills	Satisfactory	95	31.7
		Unsatisfactory	205	68.3

No	Variables		N	%
4	Informatics Knowledge	Satisfactory	115	38.3
		Unsatisfactory	185	61.7
5	Overall Competencies	Satisfactory	110	36.7
		Unsatisfactory	190	63.3

Table (4): The relation between studied nurses' attitudes to computer use, informatics competencies and their socio-demographic characteristics (n=300)

Socio-Demographic Characteristics	Attitudes				χ^2	P-value	Informatics Competencies				χ^2	P-value
	Satisfactory		Unsatisfactory				Satisfactory		Unsatisfactory			
	N	%	N	%			N	%	N	%		
Gender												
- Male	65	21.7	28	9.3	91.01	0.000**	75	25	18	6	102.07	0.000**
- Female	30	10	177	59			40	13.3	167	55.7		
Age												
- < 25 yrs.	25	8.3	14	4.7	33.77	0.000**	30	10	9	3	72.62	0.000**
- 25<30 yrs.	39	13	147	49			44	14.7	142	47.3		
- 30<35	16	5.3	29	9.7			22	7.3	23	7.7		
- ≥ 35 yrs.	15	5	15	5			18	6	12	4		
Marital Status												
- Married	42	14	135	45	12.57	0.000**	52	17.3	125	41.7	14.64	0.000**
- Unmarried	53	17.7	70	23.3			63	21	60	20		
Experience												
- < 5 yrs.	43	14.3	132	44	22.83	0.000**	53	17.7	122	40.7	30.51	0.000**
- 5<10 yrs.	29	9.7	61	20.4			34	11.3	56	18.7		
- ≥ 10 yrs.	23	7.7	12	4			28	9.3	7	2.3		
Having Computer at Home												
- Yes	60	20	185	61.7	31.81	0.000**	70	23.3	175	58.3	53.87	0.000**
- No	35	11.7	20	6.7			45	15	10	3.4		
Having Computer at Work												
- Yes	65	21.7	112	37.3	5.10	0.024*	82	27.3	95	31.7	18.64	0.000**
- No	30	10	93	31			27	9	96	32		
Training												
- Yes	73	24.3	107	35.7	16.43	0.000**	90	30	90	30	36.33	0.000**
- No	22	7.3	98	32.7			19	6.3	101	33.7		

Discussion:

Most people using health information technology are HCPs, who comprise the largest group of people working in health care. Nurses use workarounds that reduce the benefits of these technologies, which are suitable for the health of the population and the health system. This raises safety concerns [21]. But the main thing that keeps computerized systems from being used in healthcare settings is how nurses feel about using computers. The way nurses feel about using computers depends on who they are, what technology they use, and how their workplace is set up [22]. The current study's findings regarding HCPs' attitudes toward information technology revealed that most studied participants had negative attitudes toward nursing informatics. According to the researchers, this could be due to nurses' concerns that computerization would lead to job losses and/or data loss. The nurses were also worried that they would spend more time with computers and less time with patients.

These results were the same as those of **Seboka et al., (2021)** [23] and **Singh, & Masango, (2020)** [10], who also found that nurses didn't like computerization in the workplace. These results contradicted **Al-Rawajfah et al. (2016)** [24], who found that nurses generally supported workplace computerization, healthcare generally accepts computers. The results of this study about nurses' skill levels showed that their skill levels were not good enough. The researcher says these results are because not all nurses are involved in making goals, policies, and practices for the system. Only supervisors and the most experienced nurses are involved, and most nurses don't get any training on how to use computers in clinical practice settings.

This finding is consistent with **Liston (2019)** [25] finding that nurses lacked informatics competency, as well as **Farokhzadian et al. (2020)** [11] and **Al-Humran, et al., (2022)** [26] findings that nurses lacked informatics competency. According to **Alshammari et al. (2017)** [27] and **Hassona & Ali (2019)** [28], nurses who participated in competency scales scored above the competent level. Also, the previous results of this research didn't match those of **Elsayed et al., (2017)** [29] & **Kinnunen et al., (2022)** [12], who found that staff nurses knew a lot about how to use computers. Regarding the sub-dimensions of informatics competencies, according to the study's findings, the mean scores for basic computer skills, informatics skills, and informatics knowledge indicated unsatisfactory levels in all dimensions, this is due to a lack of encouragement from managers, computer training, and a lack of hospital computers. More senior staff prioritizes computers, and other staff does not have enough time to use computers in addition to their work load and nursing staff shortages, all of these can reduce nurses' competency.

These finding consistent with **Khezri & Abdekhoda (2019)** [19] found that the average score on the computer skills subscale was the lowest compared to the informatics knowledge and informatics skill subscales. **Farzandipour et al., (2021)** [20] also found that nurses were not very good at knowing about informatics, using computers, and knowing about informatics. But inconsistent with **Seo et al. (2019)** [30] found that nurses had advanced skills in clinical informatics, basic computer skills, critical roles in nursing informatics (NI), and clinical application skills. However, these results show that this is not the case. Regarding how the study variables were linked, the current results showed a strong positive link between the nurses' attitudes to computer use and their overall informatics competencies. This is because nurses with advanced competencies in informatics liked the idea of using NI in the health care system and nursing field. Using informatics competencies in nursing will also make you feel better about your job as a caregiver.

Mohamed & Abouzaied (2021) [13] found significant positive correlations in all

subscale areas of the self-assessed NI competencies and attitudes of the group they looked at. The results showed a strong link between the nurses' attitudes to use of computer and their gender, age, marital status, experience, having a computer at home, having a computer at work, having training, and having a computer at both places. This is because as nurses age, they realize the importance of computers in their lives and gain more experience. Because they used computers when they were younger, they seem to have a more positive view of technology and a better understanding of how it can be used in education and nursing. This result was in line with **Kaya (2011)** [22] (findings, who also said that age significantly affects how nurses feel about using computers. This is also in line with what found. They found that nurses' attitudes toward computers in healthcare were much more favorable than those of married nurses.

Furthermore, **Gonen & Lev-Ari (2016)** [31] found that nurses who had worked longer had a better view of computers. The results of this study disagree with those of **Ayşegül et al. (2018)** [32], who found that a positive attitude was statistically significant when it came to the age of the healthcare workers, the institution where they worked, and how long they had been using computers, but not when it came to gender, education level, job, or using computers at work. **Ademuyiwa et al., (2020)** [33] found that people of all ages had the same feelings about computers in healthcare. Significant relationships existed between studied nurses' overall informatics competencies and gender, age, marital status, experience, a computer at home, a computer at work, and training. According to the researchers, younger nurses are more open to and familiar with technology than older nurses. On the other hand, older nurses are encouraged to be more open to technology to meet the challenges of providing quality healthcare in the twenty-first century.

Mohamed et al. (2022) [34] also found that nurses' informatics skills changed significantly depending on their age, level of education, years of experience, and where they worked. They also found that the number of years of experience had the opposite effect on their nursing informatics skills. In the same line, these findings concur with **Rizany et al., (2018)** [35], who discovered that personal factors like age, gender, and education had been found to affect how well nurses get better at their jobs. **Bove & Sauer (2022)** [36] also concluded that informatics competency is significantly related to age, gender, and years of experience. These findings are consistent with the findings of **Kleib & Nagle (2018)** [37], who found that scores on informatics skills were very different depending on age, education, years of experience, and work setting. **Liston (2019)** [25], on the other hand, said that age, experience, education level, and gender had no statistically significant effect on informatics competency scores. **Mohamed et al. (2022)** [34] **& Liston (2019)** [25] discovered no statistical link between education level and nursing informatics skills.

Conclusion

The results of this study show that most studied participants had negative attitudes toward nursing informatics. The overall mean of the informatics competencies of the studied participants indicated unsatisfactory informatics competencies. The sub-dimensions of informatics competencies and the mean score for basic computer skills, informatics skills, and informatics knowledge were all unsatisfactory. There was a significant positive correlation between the HCPs' attitudes and their overall informatics competencies. Based on what this study found, it is suggested that the following: Designing appropriate training programs to help HCPs maintain familiarity with new information technologies. Provide resources and funding to hospitals to build the infrastructure required to promote nurses' competence in nursing informatics and new technologies.

References:

1. Frenk J, Chen LC, Chandran L, Groff EOH, King R, Meleis A, Fineberg HV. Challenges and

opportunities for educating health professionals after the COVID-19 pandemic. Lancet. 2022 Oct 29;400(10362):1539-1556. doi: 10.1016/S0140-6736(22)02092-X. PMID: 36522209; PMCID: PMC9612849.

2. Yogesh MJ, Karthikeyan J. Health Informatics: Engaging Modern Healthcare Units: A Brief Overview. Front Public Health. 2022 Apr 29;10:854688. doi: 10.3389/fpubh.2022.854688. PMID: 35570921; PMCID: PMC9099090.
3. Buntin M, Burke M, Hoaglin M, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. Health Aff. (2011) 30:464–71. 10.1377/hlthaff.2011.0178
4. Ravi D, Wong C, Deligianni F, Berthelot M, Andreu-Perez J, Lo B, et al.. Deep learning for health informatics. IEEE J Biomed Health Inform. (2016) 21:4–21. 10.1109/JBHI.2016.2636665
5. Mantas, J., Ammenwerth, E., Demiris, G., Hasman, A., Haux, R., Hersh, W., Wright, G. (2010). Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics. First Revision. Methods of Information in Medicine, 49(2), 105–120. doi:10.3414/ME5119
6. Guna, S., Nita Y., & Premono J. (2020): "Barriers and Opportunities of Using Electronic Nursing Record in Indonesia: Nurses' Perspective." ICIC Express Letters Part B: Application 11(12): 1159-1164.
7. Zareshahi, M., Mirzaei S., & Nasiriani K. (2022): "Nursing informatics competencies in critical care unit." Health Informatics Journal 28(1): 14604582221083843.
8. Nsouli, R., & Vlachopoulos D. (2021): "Attitudes of nursing faculty members toward technology and e-learning in Lebanon." BMC nursing 20(1): 1-15.
9. Al-Balawi, Z., Taie S., & Alsesei N. (2020): Nursing Informatics Competency Based Assessment for Nursing Personnel in Primary Healthcare Centers in Tabuk, King Abdul-Aziz University.
10. Singh, F., & Masango T. (2020): "Information technology in nursing education: perspectives of student nurses ".The Open Nursing Journal 14.(1)
11. Farokhzadian, J., Khajouei, R., Hasman A., & Ahmadian L. (2020): "Nurses' experiences and viewpoints about the benefits of adopting information technology in health care: a qualitative study in Iran." BMC Medical Informatics and Decision Making 20(1): 1-12.
12. Kinnunen, U.-M., Kuusisto, A., Ahonen, O. Koponen, S. Kaihlanen, A. Hassinen T. & Vehko T. (2022): "Nurses' informatics competency assessment of health information system usage: a cross-sectional survey." Research Square.
13. Mohamed, L., & Abouzaied M. (2021): "Selfassessment of nursing informatics competencies and attitudes among baccalaureate-nursing students." Egyptian Nursing Journal 18(1): 28.
14. Joseph, M., Inayat, A., Hussain M., & Afzal M. (2019): "Factors influencing nurses' attitudes towards information technology in nursing practice." European Academic Research 7(3): 1751-1769.
15. Kamal, P. (2021): Benefits of Technologies for Nurses and Residents in A Nursing Home – A Descriptive Literature Review. Bachelor's Thesis, Lapland University of Applied Sciences.
16. Terkes, N., Celik F., & Bektas H. (2019): "Determination of nursing students' attitudes towards the use of technology." Japan Journal of Nursing Science 16(1): 17-24.
17. Thompson, S. (2012): Sampling, John Wiley & Sons.
18. Watson, D., & Carberry M. (2021): "Nurses' experiences of recording vital signs electronically: a pilot study." Nursing Times: 53-56.
19. Khezri, H., & Abdekhoda M. (2019): Assessing nurses' informatics competency and identifying its related factors." Journal of Research in Nursing 24(7): 529-538.
20. Farzandipour, M., Mohamadian, H., Akbari, H., Safari S., & Sharif R. (2021): "Designing a national model for assessment of nursing informatics competency." BMC medical informatics and decision making 21(1): 1-12.
21. Rathert, C., Porter, T., Mittler J., & Fleig- Palmer M. (2019): "Seven years after Meaningful Use: Physicians' and nurses' experiences with electronic health records." Health care management review 44(1): 30-40.
22. Kaya, N. (2011): "Factors affecting nurses' attitudes toward computers in healthcare." CIN: Computers, Informatics, Nursing 29(2): 121-129.
23. Seboka, B., Yilma T., & & Birhanu A., (2021): "Factors influencing healthcare providers' attitude and willingness to use information technology in diabetes management." BMC medical informatics and decision making 21(1): 1-10.

24. AL-Rawajfah, O. (2016): "Infection control practices among intensive care unit registered nurses: a Jordanian national study." Nursing in critical care 21(2): e-02e27
25. Liston, J., (2019): Advanced Informatics competencies of nurses at sutter maternity and surgery. PhD, San Jose State University.
26. Al-Humran, B., Mohammad, S., & Malakeh, Z. (2022): The Relationship Between Nursing Informatics Competency and Clinical Decision- Making Among Nurses in West Bank, Palestine. CIN: Computers, Informatics, Nursing: August 2022 - Volume 40 - Issue 8 - p 547-553 doi: 10.1097/CIN.0000000000000890
27. Alshammari, F., Pasay-an E., & Indonto C. (2017): "Competencies in Nursing Informatics in the Saudi Arabian Context: A Sequential Explanatory Study." Philippine Journal of Nursing 87(2): 45-55.
28. Hassona, F., & Ali A. (2019): "Relationship between Nursing Informatics Competency and Innovativeness among Qualified Nurses." Evidence- Based Nursing Research 1(3): 9-9.
29. Elsayed, W., Hussein F., & Othman N. (2017): "Relation between nursing informatics competency and Nursesâ€™ attitude toward evidence-based practice among qualified nurses at Mansoura oncology center." International Journal of Nursing Didactics 7(6): 26-33.
30. Seo, K., Min, Y., Choi S.-H., & Lee H. (2019): "Evaluation of the Korean version of the self-assessment of nursing informatics competencies scale." BMC nursing 18(1): 1-9.
31. Gonen, A., & Lev-Ari L. (2016): "The relationship between work climate and nurse educators' use of information technology." Nurse Education Today 39: 1-6.
32. Ayşegül, K. Mahmut, Dilek, Ö., Erdal C., & Kamile S. (2018): "Health Care Professionals' Attitudes about Using Computer. LOJ Nur Heal Car 1 (3)-2018." LOJNHC. MS. ID 111.
33. Ademuyiwa, I., Faleke S., & Otetubi E. (2020): "Knowledge and Use of Nursing Informatics among Nurses in a University Teaching Hospital in Lagos, Nigeria".
34. Mohamed, T., Abdallah A., Abdelwahab K., & Elsayed A. (2022): "Factors Contributing to The Application of Information Technology System and Their Benefits." Port Said Scientific Journal of Nursing 9(1): 52-76.
35. Rizany, I., Hariyati R., & Handayani H. (2018): "Factors that affect the development of nurses' competencies: a systematic review." Enfermeria clinica 28: 154-157.
36. Bove, L., & Sauer P. (2022): "Nursing Faculty Informatics Competencies." CIN: Computers, Informatics, Nursing.
37. Kleib, M., & Nagle L. (2018): "Factors associated with Canadian nurses' informatics competency." CIN: Computers, Informatics, Nursing 36(8): 406- 415.