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The associations of nursing informatics competence and stress related to information systems (SRIS) in the well-being of nurses in Saudi Arabia 2024

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ABSTRACT

Background: The majority of nurses' working hours are spent using information systems. Increased usage of the systems is known to be a potential source of stress and necessitates that nurses possess sufficient nursing informatics competency.The workplace environment of nurses concerns nurse administrators and information technology; a well-established tool that assists healthcare and nurses in doing their job effectively. Nursing informatics competence and stress related to information systems can be important variables to understand the well-being of nurses using information systems. However, evidence is so far insufficient for understanding their associations and effects on the well-being of nurses.

The study aims: To examine whether SRIS and nursing informatics competence are associated with stress and psychological distress in newly graduated nurses (NGNs) and experienced nurses.

Methods: A cross-sectional study was conducted in KSA between January and March 2024. The participants were NGNs (n = 712) with less than two years of work experience and experienced nurses (n = 1226) with more than two years of work experience. The associations of nursing informatics and SRIS with nurses' stress and psychological distress were analyzed with linear regression analysis. Analyses were conducted separately for NGNs and experienced nurses. Models were adjusted for age, gender, and work environment.

Results: SRIS was associated with stress / psychological distress for both NGNs ($\beta = 0.26$ $p < 0.001$ / $\beta = 0.22$ $p < 0.001$) and experienced nurses ($\beta = 0.21$ $p < 0.001$/ $\beta = 0.12$ $p < 0.001$). Higher nursing informatics competence was associated with lower stress ($\beta = 0.20$ $p < 0.001$) and psychological distress ($\beta = 0.16$ $p < 0.001$) in NGNs, but not among experienced nurses.

Conclusions: SRIS appears to be an equal source of stress and distress for nurses who are starting their careers and for more experienced nurses, who are also likely to be more experienced users of information systems. However, informatics competence played a more important role among NGNs and a lack of adequate competence seems to add to the strain that is already known to be high in the early stages of a career. It would be important for educational institutions to invest in nursing informatics so that new nurses entering the workforce have sufficient skills to work in increasingly digital health care.

Keywords: Information systems, stress, informatics, competence, well-being, newly graduated nurse.

INTRODUCTION

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 (1). Information Technology (IT) is the creation, distribution, and use of information technology in health care to create, store, and manage health information. According to the American Nursing Informatics Association, an informatics nurse uses nursing science, computer science, and information science to collect, process, and manage data to provide nursing principles, clinical care, education, research, and nursing knowledge development (2).

Nursing informatics (NI) is a tool for giving safe, high-quality care to patients 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. Nurses 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 (3). Also, 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 because nurses don't have the right skills or don't know enough about IT. So, nurses need to know more about health information technology and management and more informatics training(4).

Nursing informatics has greatly transformed over the years. With the world revolving around technology in modern times, the topic of nursing informatics is important. Nursing informatics is a continuously evolving field. Nurses use the data from technology and analyze, interpret and evaluate them to promote best care (5). In order to store and share data, information, and knowledge to help patients, nurses, and other providers in the decision making process across all roles and contexts, Another word for these technologies that help nurses manage patient care and health care more effectively and efficiently while also increasing nurse accountability is nursing informatics (6).

Additionally, Utilizing information technology has become essential to providing healthcare. As part of patient care, nurses and other medical personnel must embrace digital services and information systems (7, 8). Although information systems are anticipated to be advantageous from an economic and quality-of-care standpoint (9), they may also have negative effects on end users, such as more stress and strain from adjusting to new information systems and workflows(10-13).

The broad assessment of stress symptoms has been used extensively to gauge well-being at work, as stress is thought to be a reaction to a stressful circumstance (14). One of the most popular and well-researched measures of well-being is psychological distress, which is defined as a state of emotional suffering brought on by demands and stressors that a person finds challenging to manage in daily life (General Health Questionnaire, GHO) (15, 16). The stress brought on by malfunctioning or dynamic information systems is known as stress related to information systems (SRIS) (17).

The SRIS of nurses has not received as much attention as that of, say, doctors (18). SRIS use among doctors has been rising gradually in recent years (17), and multifunctional information systems have been linked to stress, particularly when work requires a lot of time (19-21). Information systems, including the need for thorough and precise documentation in health records, have also been proven to cause significant stress and to take more time away from daily work than previously for nurses (22-24). In order to offer care in digital contexts, nurses must constantly redefine their nursing knowledge, according to studies (7). Additionally, nurses' stress and cognitive strain have been linked to the information systems' poor usability (25-27).

There is a lot of learning and adaptation during the first few years of professional nursing practice, which is known to be stressful (28, 29). Therefore, for recently graduated nurses (NGNs), using information systems may be especially stressful. NGNs experience stress mostly from challenges including managing high workloads, satisfying expectations for their working lives (30-32), and gaps in competence (28-35). Conversely, it has been demonstrated that lower stress levels are predicted by greater task competence (36).

A prerequisite for nurses' performance in digitizing healthcare is proficiency in nursing informatics, which is the processing of information and integration of information and communication technologies to improve the health of patients or clients (37-41). It is anticipated that NGNs who enter the workforce will possess adequate informatics skills and be prepared to utilize information systems efficiently (42). The degree to which contemporary nursing courses satisfy this competency need has been questioned, nevertheless (43, 44).

There have been numerous reports of deficiencies in students' theoretical studies as well as in their opportunities to experience using nursing informatics and the systems prior to entering the workforce(42, 45-47). Additionally, there is a lack of clarity regarding the best ways to train and guarantee that nurses have adequate informatics competency (45). Furthermore, the absences of formal training and irrational expectations for information technology competency have been criticized by nurses at various career phases (7, 24).

Although the stress of NGNs, and nurses in general, is a widely studied topic (31, 48, 49), little is known about the potential impact of SRIS or nursing informatics competence on nurses' overall well-being. Moreover, the potential impact of a nurse's career stage on this matter is unknown. Therefore, this study aims to examine whether SRIS and nursing informatics competence are associated with stress and psychological distress in NGNs and experienced nurses.

METHODS

A cross-sectional survey study was conducted in KSA between January and March 2024.The study included two groups of participants. The first group consisted of NGNs and the second group consisted of registered nurses with more than two years of work experience.Nurses were invited to participate in the study and were sent a link to the electronic questionnaire via email. The invitation letter contained information on the purpose of the study, the voluntary nature of completing/sending the questionnaire, and the fact that the information will be processed both without identification of the participant and only by the members of theresearch team. A total of 712 NGNs (response rate: 18 %) and 1226 experienced nurses (response rate: 15 %) responded to the survey after three email reminders were sent.

Stress was measured with a validated single-item measure of stress symptoms (14): 'Stress means feeling tense,

restless, nervous or anxious or being unable to sleep at night because one's mind is troubled all the time. Do you feel stressed these days?' The item was answered on a five-point scale (ranging from 1 = 'not at all' to 5 = 'very much').Psychological distress was measured using four items (Cronbach's alpha: α = 0.86) from the General Health Questionnaire (GHQ) (15, 50) that represent the anxiety/ depression factor and is suggested to be the most preferable factor model for GHQ-12 (6). Previously this measure has been associated with, for example, team climate and patient-related stress (51, 52). Items, such as 'have you recently felt constantly under strain?' were assessed on a four-point scale (ranging from 1 = 'not at all' to 4 = 'a lot more than usually').

SRIS was measured by two items (α = 0.62) that assessed how often a person has been distracted, worried, or stressed during the last six months about (1) constantly changing information systems and (2) difficult, poorly functioning IT equipment/software (17) on a five-point scale (ranging from 1 = 'very rarely or never' to 5 = 'very often or constantly'). The measure has been used in studies that have included physicians and has been associated with, for example, psychological distress (20, 21).

Nursing informatics competence included four competence areas: (1) terminology-based documentation, (2) patient-related digital work, (3) general IT competency, and (4) electronic documentation according to structured national headings (39). The participants were asked to evaluate how well they have mastered the following competencies on a five-point scale (ranging from 1 = 'very poorly' to 5 = 'very well'): documentation by using structured national headings (competency 1); supporting the patient to use electronic services (competency 2); basic IT skills (e.g. data security information retrieval, word processing) (competency 3); and electronic documentation of the patient care according to the nursing process (competency 4) (α = 0.73).

Demographic information included age, gender, and the work environment (emergency care, psychiatric and substance abuse services, specialized health care, elderly care, an outpatients department, or some other environment).

Multiple linear regressionswere used to examine the associations of SRIS and nursing informatics competence with stress and psychological distress. Analyses were conducted separately for both dependent variables (stress and psychological distress). First, as a preliminary analysis, we tested whether the possible associations of SRIS and informatics competence with stress and distress are different between NGNs and experienced nurses. This was done by combining the data from both nurse groups and included the interaction terms 'SRIS*- nurse group' and 'informatics competence*nurse group' in the models predicting stress and distress. There was a significant interaction effect between nursing informatics competence and the nurse group for stress ($p = 0.04$) and psychological distress ($p = 0.04$). Therefore, the analyses were conducted separately for NGNs and experienced nurses. All models were adjusted for age, gender, and work environment. The analyses were conducted using R, version 1.2.1335.

RESULTS

Table (1) shows that the majority of the nurses were female. NGNs were on average 31 years old and experienced nurses 45 years old. In both groups, specialized health care and elderly care were the most common work environments. Nursing informatics competence was higher ($p < 0.001$) and SRIS was lower ($p < 0.001$) among NGNs compared with experienced nurses. The groups did not vary in the level of stress or psychological distress.

Table 1: The characteristics of the participants and descriptive statistics

	Freq / % mean (SD)	
	NGNs	Exp Ns
Age	31.06(8.73)	44.92(11.18)
Gender		
Male	77/10.9%	88/7.2%
Female	627/89.1%	1134/92.8%
Workenvironment		
Emergencycare	105/15.2%	96/8.1%
Psychiatricandsubstanceabuseservices	94/13.6%	137/11.9%
Specializedhealthcare	260/37.7%	376/31.8%
Elderlycare	161/23.4%	306/25.9%
Receptionwork	36/5.2%	114/9.6%
Other	33/4.8%	154/13.0%
Stress(range:1–5)	2.72(1.08)	2.71(1.10)
Psychologicaldistress(1–4)	2.09(0.77)	2.10(0.76)
Informaticscompetence(1–5)	4.02(0.61)	3.86(0.67)

	Freq / % mean (SD)	
	NGNs	Exp Ns
SRIS(1–5)	2.57(0.85)	2.94(0.85)

NGNs=newlygraduatednurses,Exp Ns=experiencednurses.

Table (2) shows that SRIS was significantly associated with stress and distress in both NGNs and experienced nurses. Nursing informatics competence was associated with stress and distress in NGNs but not in experienced nurses.

Table 2: The associations of independent variables with nurses' stress and psychological distress

	NGNs		Exp Ns	
Stress	Est.	p	Est.	p
Informaticscompetence	-0.20	<0.001	-0.02	0.65
SRIS	0.26	<0.001	0.21	<0.001
Age	-0.02	<0.001	-0.02	<0.001
Gender(female)	0.41	<0.001	0.34	0.01
Workenvironment				
Emergencycare	Ref	-	Ref	-
Psychiatric and substance abuse services	0.22	0.15	0.32	0.03
Specialised health care	0.21	0.08	0.13	0.31
Elderlycare	0.29	0.03	0.20	0.12
Outpatientsdepartment	0.00	1.00	0.06	0.68
Other	0.09	0.69	0.17	0.24
Psychologicaldistress				
Informaticscompetence	-0.16	<0.001	-0.03	0.31
SRIS	0.22	<0.001	0.12	<0.001
Age	-0.01	<0.001	-0.01	<0.001
Gender(female)	0.18	0.06	0.17	0.05
Workenvironment				
Emergencycare	Ref	-	Ref	-
Psychiatric and substance abuse services	0.24	0.02	0.11	0.28
Specialised healthcare	0.17	0.05	0.00	0.98
Elderlycare	0.27	0.00	0.12	0.19
Outpatientsdepartment	0.12	0.40	-0.04	0.73
Other	0.29	0.06	0.05	0.47
NGNs=newly graduated nurses,ExNs=experienced nurses				

DISCUSSION

This study examined whether SRIS and nursing informatics competence are associated with stress and psychological distress in NGNs and experienced nurses. The present results showed that high SRIS were associated with high stress and distress in both groups. High nursing informatics competence, in turn, was associated with low levels of stress and distress in NGNs, but not among experienced nurses.According to our results, SRIS appears to be a source of stress and psychological distress for nurses, regardless of the stage of their career. A previous study by Harris et al. (2018)(18) has similarly found that stress due to electronic health record use may be associated with nurses' burnout symptoms.

Nurses are known to experience stress, especially in the implementation phase of new information systems (53), and this most likely occurs due to the high workload and lack of time that are typical barriers to the adoption and acceptance of the systems (54). In the present study, the SRIS levels were significantly higher for experienced nurses than for NGNs, but werestill at a moderate level in both groups compared with, for example, the SRIS levels for physicians (20, 21). Moreover, long experience with the use of information systems has been associated with lower SRIS levels in physicians, not the other way around (20). The difference in nurses' SRIS values can be partly explained by the fact that a significant proportion of NGNs represent a generation that is familiar with using a wide range of technologies, both in their studies and in their leisure time (55).

On the other hand, the widespread use of technology (e.g. in social interaction and knowledge sharing) does not directly indicate the ability to use these skills in academic or professional activities exists (47). Nevertheless, NGNs attitudes and perceived self-efficacy in information and communication technology, and their

understanding of its benefits appear to be higher than that of nurses with more experience and age (56, 57). This may to some extent protect NGNs from SRIS in the workplace, but our results suggest that SRIS still affects their well-being.Based on the results, a lack of sufficient nursing informatics competence may increase NGNs' perceived stress and distress. NGNs evaluated themselves to be more competent in nursing informatics than experienced nurses, who is consistent with previous knowledge (40), although having more experience in the useof health information systems has previously been associated with higher informatics competence among nurses(39).

Integrating nursing informatics into nursing education has been a mission in many countries, but global and national differences in the use of technologies have made it difficult to determine best teaching practices and ensure the coherence of curricula (58). This study confirms the need to invest in adequate informatics education as good competence may alleviate the stress and distress in the first years of a nurse's work. Even though the level of informatics competence was not similarly associated with stress or distress among more experienced nurses, the provision of on-the-job training about informatics would also be extremely important.

Previous studies have stated the need to develop, for example, nurses' competence in using online services in patient care, supporting patients in utilizing these services (7, 59), structured documentation, and basic IT skills (60). It is worth investing in the development of these competencies as there is repeated evidence of a link between the training received and nurses' informatics competence (39, 61). Moreover, the importance of nursing informatics for ensuring the quality of health care is well recognized inter- nationally (62- 65).

So far, research knowledge on the stress caused by poorly functioning and constantly changing information systems is scarce among nurses, making it difficult to compare its potential effects on different health and social care settings and professionals at different career stages or to make international comparisons. As the use of various information systems is likely to increase globally in the future, further research is needed in this regard.

CONCLUSIONS

According to this study, poorly functioning, constantly changing information systems can be a substantial source of stress and psychological distress for NGNs as well as more experienced nurses. It is the responsibility of system vendors to further develop information systems to better support the work of healthcare professionals and not to increase their workload and strain. These findings also suggest that good nursing informatics competence may be especially important for nurses who are starting their career in terms of preventing early career stress and distress, although adequate nursing informatics competence is known to be of the utmost importance and a prerequisite for performing work at any stage in a nurse's career.

It would be very important to take into account the stressors of nurses and invest in their well-being as this might mitigate nurses' professionchanges in a situation where there is already a global shortage of nurses. The tasks in nursing that require information management skills will increase in the future, thus, providing adequate and appropriate support and training in the use of information systems would be very important in both educational institutions and health care organizations.

REFERENCES

1. Guna, S., Nita, Y. and 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.
2. Wager, K. A., Lee, F. W. and Glaser, J. P. (2022): Health Care Information Systems: A Practical Approach for Health Care Management, 5th Ed. 416 p.
3. Al-Balawi, Z., Taie S. and Alsesei, N. (2020): Nursing Informatics Competency Based Assessment for Nursing Personnel in Primary Healthcare Centers in Tabuk, King Abdul-Aziz University. Am. Res. J. Nurs., 6(1): 1-17.
4. Farokhzadian, J., Khajouei, R., Hasman, A. and Ahmadian, L. (2020): Nurses' experiences and viewpoints about the benefits of adopting information technology in health care: a qualitative study in Iran. BMC Med. Inform. Decis. Mak., 20(1): 1-12.
5. Ulanday, K. (2023): Nursing informatics. Am. J. Nurs., 123(6): 17
6. Kovačić, M., Mutavdžija, M. and Buntak, K. (2022): E-Health Application, Implementation and Challenges: A Literature Review. Business Systems Research, 13(1): 1-18.
7. Öberg U, Orre CJ, Isaksson U, Schimmer R, Larsson H, Hörnsten Å. Swedish primary healthcare nurses' perceptions of using digital eHealth services in support of patient self-management. Scand J Caring Sci 2018;32(2):961–970.
8. Rouleau G, Gagnon M, Côté J, Payne-Gagnon J, Hudson E, Dubois C. Impact of information and communication technologies on nursing care: results of an overview of systematic reviews. Journal of medical Internet research 2017;19(4):e122.
9. Buntin MB, Burke MF, Hoaglin MC, Blumenthal D. The benefits of health information technology: a review of the recent literature shows predominantly positive results. Health Aff 2011;30(3):464–471.
10. Bristol AA, Nibbelink CW, Gephart SM, Carrington JM. Nurses' use of positive deviance when

encountering electronic health records-related unintended consequences. Nurs Adm Q 2018;42(1):E1-E11.
11. Gephart S, Carrington JM, Finley B. A systematic review of nurses' experiences with unintended consequences when using the electronic health record. Nurs Adm Q 2015;39(4):345–356.
12. Fleming NS, Culler SD, McCorkle R, Becker ER, Ballard DJ. The financial and nonfinancial costs of implementing electronic health records in primary care practices. Health Aff 2011;30(3):481–489.
13. Menachemi N, Collum TH. Benefits and drawbacks of electronic health record systems. Risk management and healthcare policy 2011;4:47.
14. Elo A, Leppänen A, Jahkola A. Validity of a single-item measure of stress symptoms. Scand J Work Environ Health 2003:444–451.
15. Graetz B. Multidimensional properties of the General Health Questionnaire. Soc Psychiatry Psychiatr Epidemiol 1991;26(3):132–138.
16. Penninkilampi-Kerola V, Miettunen J, Ebeling H. A comparative assessment of the factor structures and psychometric properties of the GHQ-12 and the GHQ-20 based on data from a Finnish population-based sample. Scand J Psychol 2006;47(5):431–440.
17. Heponiemi T, Hyppönen H, Vehko T, Kujala S, Aalto A, Vänskä J, et al. Finnish physicians' stress related to information systems keeps increasing: a longitudinal three-wave survey study. BMC medical informatics and decision making 2017;17(1):147.
18. Harris DA, Haskell J, Cooper E, Crouse N, Gardner R. Estimating the association between burnout and electronic health record-related stress among advanced practice registered nurses. Applied Nursing Research 2018;43:36–41.
19. Babbott S, Manwell LB, Brown R, Montague E, Williams E, Schwartz M, et al. Electronic medical records and physician stress in primary care: results from the MEMO Study. Journal of the American Medical Informatics Association 2014;21(e1):e100-e106.
20. Heponiemi T, Hyppönen H, Kujala S, Aalto A, Vehko T, Vänskä J, et al. Predictors of physicians' stress related to information systems: a nine-year follow-up survey study. BMC health services research 2018;18(1):284.
21. Heponiemi T, Kujala S, Vainiomäki S, Vehko T, Lääveri T, Vänskä J, et al. Usability Factors Associated With Physicians' Distress and Information System–Related Stress: Cross-Sectional Survey. JMIR medical informatics 2019;7(4):e13466.
22. Baumann LA, Baker J, Elshaug AG. The impact of electronic health record systems on clinical documentation times: A systematic review. Health Policy 2018;122(8):827–836.
23. Moore EC, Tolley CL, Bates DW, Slight SP. A systematic review of the impact of health information technology on nursesâ€™ time. Journal of the American Medical Informatics Association 2020;27(5):798–807.
24. Chi-Ping Chang, Ting-Ting Lee, Chia-Hui Liu, Mills ME. Nurses' Experiences of an Initial and Reimplemented Electronic Health Record Use. CIN COMPUT INFORM NURS 2016;34(4):183–190.
25. Vehko T, Hyppönen H, Puttonen S, Kujala S, Ketola E, Tuukkanen J, et al. Experienced time pressure and stress: electronic health records usability and information technology competence play a role. BMC medical informatics and decision making 2019;19(1):160.
26. Colligan L, Potts HW, Finn CT, Sinkin RA. Cognitive workload changes for nurses transitioning from a legacy system with paper documentation to a commercial electronic health record. Int J Med Inf 2015;84(7):469–476.
27. Saitwal H, Feng X, Walji M, Patel V, Zhang J. Assessing performance of an Electronic Health Record (EHR) using Cognitive Task Analysis. International Journal of Medical Informatics 2010;79(7):501–506.
28. Halpin Y, Terry LM, Curzio J. A longitudinal, mixed methods investigation of newly qualified nurses' workplace stressors and stress experiences during transition. J Adv Nurs 2017;73(11):2577–2586.
29. Walker A, Costa BM, Foster AM, de Bruin RL. Transition and integration experiences of Australian graduate nurses: A qualitative systematic review. Collegian 2017;24(5):505–512.
30. Labrague LJ, McEnroe-Pettite D, Leocadio MC. Transition experiences of newly graduated Filipino nurses in a resource-scarce rural health care setting: A qualitative study. Nurs Forum 2019 Apr;54(2):298–306.
31. Labrague LJ, McEnroe-Petitte DM. Job stress in new nurses during the transition period: an integrative review. Int Nurs Rev 2018;65(4):491–504.
32. Tingleff EB, Rossen CB, Buus N, Poelvoorde TL. A qualitative metasynthesis of psychiatric nurses' experiences of the transition from being student to being newly qualified. VARD I NORDEN 2016;30(1):45; 1–47; 1.
33. Kumaran S, Carney M. Role transition from student nurse to staff nurse: facilitating the transition period. Nurse Educ Pract 2014 Nov;14(6):605–611.
34. Zamanzadeh V, Jasemi M, Valizadeh L, Keogh B, Taleghanis F. Lack of Preparation: Iranian Nurses' Experiences during Transition from College to Clinical Practice. J Prof Nurs 2015 Jul;31(4):365–373.
35. Watson R, Gardiner E, Hogston R, Gibson H, Stimpson A, Wrate R, et al. A longitudinal study of stress and

psychological distress in nurses and nursing students. J Clin Nurs 2009;18(2):270–278.
36. Frögéli E, Rudman A, Gustavsson P. The relationship between task mastery, role clarity, social acceptance, and stress: An intensive longitudinal study with a sample of newly registered nurses. International Journal of Nursing Studies 2019; 91:60–69.
37. Staggers N, Gassert CA, Curran C. A Delphi study to determine informatics competencies for nurses at four levels of practice. Nurs Res 2002; 51(6):383– 390.
38. Staggers N, Thompson CB. The evolution of definitions for nursing informatics: a critical analysis and revised definition. Journal of the American Medical Informatics Association 2002;9(3):255–261.
39. Kinnunen U, Heponiemi T, Rajalahti E, Ahonen O, Korhonen T, Hyppönen H. Factors Related to Health Informatics Competencies for Nurses—Results of a National Electronic Health Record Survey. CIN: Computers, Informatics, Nursing 2019;37(8):420–429.
40. Khezri H, Abdekhoda M. Assessing nurses' informatics competency and identifying its related factors. Journal of Research in Nursing 2019;24(7):529– 538.
41. T.I.G.E.R. Competencies for Every Practicing Nurse: Recommendations from the TIGER Collaborative. 2011;. Accessed 1.6., 2020.
42. Shin EH, Cummings E, Ford K. A qualitative study of new graduatesâ€™ readiness to use nursing informatics in acute care settings: clinical nurse educatorsâ€™ perspectives. Contemporary nurse 2018;54(1):64–76.
43. Teaching Nursing Informatics in Australia, Canada and Denmark. CSHI; 2015.
44. Foster M, Sethares K. Current strategies to implement informatics into the nursing curriculum: an integrative review. J Nurs Inform 2017;21(3).
45. Forman TM, Armor DA, Miller AS. A Review of Clinical Informatics Competencies in Nursing to Inform Best Practices in Education and Nurse Faculty Development. Nursing education perspectives 2020;41(1):E3-E7.
46. Miller L, Stimely M, Matheny P, Pope M, McAtee R, Miller K. Novice nurse preparedness to effectively use electronic health records in acute care settings: Critical informatics knowledge and skill gaps. Online Journal of Nursing Informatics (OJNI) 2014;18(2).
47. Nwosu JC, John HC, Izang AA, Akorede OJ. Assessment of Information and Communication Technology (ICT) Competence and Literacy Skills among Undergraduates as a Determinant Factor of Academic Achievement. Educational Research and Reviews 2018;13(15):582–589.
48. Olvera Alvarez HA, Provencio-Vasquez E, Slavich GM, Laurent JGC, Browning M, McKee-Lopez G, et al. Stress and Health in Nursing Students: The Nurse Engagement and Wellness Study. Nurs Res 2019 Nov;68(6):453–463.
49. Badu E, Oâ€™Brien AP, Mitchell R, Rubin M, James C, McNeil K, et al. Workplace stress and resilience in the Australian nursing workforce: A comprehensive integrative review. International Journal of Mental Health Nursing 2020;29(1):5–34.
50. Goldberg DP, Gater R, Sartorius N, Ustun TB, Piccinelli M, Gureje O, et al. The validity of two versions of the GHQ in the WHO study of mental illness in general health care. Psychol Med 1997;27(1):191–197.
51. Aalto A, Heponiemi T, Josefsson K, Arffman M, Elovainio M. Social relationships in physicians' work moderate relationship between workload and wellbeing—9-year follow-up study. Eur J Public Health 2018;28(5):798– 804.
52. Heponiemi T, Aalto A, Puttonen S, Vänskä J, Elovainio M. Work-related stress, job resources, and well-being among psychiatrists and other medical specialists in Finland. Psychiatric services 2014;65(6):796–801.
53. Lee T. Nurses' experiences using a nursing information system: early stage of technology implementation. CIN: Computers, Informatics, Nursing 2007; 25(5):294–300.
54. McGinn CA, Grenier S, Duplantie J, Shaw N, Sicotte C, Mathieu L, et al. Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: a systematic review. BMC medicine 2011;9(1):46.
55. Montenery SM, Walker M, Sorensen E, Thompson R, Kirklin D, White R, et al. Millennial generation student nursesâ€™ perceptions of the impact of multiple technologies on learning. Nursing education perspectives 2013; 34(6):405–409.
56. Chérrez-Ojeda I, Felix M, Mata VL, Vanegas E, Simancas-Racines D, Aguilar M, et al. Use and perceptions of information and communication technologies among Ecuadorian nurses: a cross-sectional study. The Open Nursing Journal 2020;14(1).
57. Warshawski S, Itzhaki M, Barnoy S. Nurse and Nurse Student Attitudes and Perceived Self-efficacy in Use of Information and Communication Technologies: Professional and Cultural Differences. CIN: Computers, Informatics, Nursing 2019;37(1):20–28.
58. De Gagne JC, Bisanar WA, Makowski JT, Neumann JL. Integrating informatics into the BSN curriculum: A review of the literature. Nurse Educ Today 2012; 32(6):675–682.

59. Health Professionals' Expanding eHealth Competences for Supporting Patients' Self-Management. MIE; 2018.
60. Tolonen J, Värri A. Survey of health informatics education in Finland in 2017. Finnish Journal of eHealth and eWelfare 2017;9(2–3):217–231.
61. Chung SY, Staggers N. Measuring nursing informatics competencies of practicing nurses in Korea: nursing informatics competencies questionnaire. CIN: Computers, Informatics, Nursing 2014;32(12):596–605.
62. Lin H, Hsu M, Yang C. The influences of computer system success and informatics competencies on organizational impact in nursing environments. CIN: Computers, Informatics, Nursing 2014;32(2):90–99.
63. Darvish A, Bahramnezhad F, Keyhanian S, Navidhamidi M. The role of nursing informatics on promoting quality of health care and the need for appropriate education. Global journal of health science 2014;6(6):11.
64. Tavakol M, Dennick R. Making sense of Cronbach's alpha. Int J Med Educ 2011 Jun 27;2:53–55.
65. ALL European Academies. The European Code of Conduct for Research Integrity. 2017; Available at: https://ec.europa.eu/research/participants/data/ ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf.