**Determining the Challenges of Nursing Informatics from the Perspective of Faculty Nurses at Birjand University of Medical Sciences: A Mixed Method**

**Abstract:**

**Aims:** Nursing Informatics (NI) is a rapidly growing domain that combines nursing, computer, and information technology sciences to manage and transfer data, information, and knowledge in nursing activities. Despite the benefits of nursing informatics such as facilitating information management and decision-making for nurses, the implementation of this technology is challenging. The objective of this study was to identify the nursing informatics challenges.

**Methods:** This applied study was conducted in 2024 during a three-stage process. First, a systematic review was conducted using PubMed, Scopus, and Web of Science. Second, the challenges were determined based on a focus group discussion and selected through a two-round Delphi technique. Third, the responses collected after each round were through descriptive statistics (frequency and percentage) in Microsoft Excel 2019. Following each round, the responses were analyzed by calculating frequencies and percentages.

**Finding:** A total of 33 challenges were examined by nurses in the first round of Delphi. After the second round, 32 challenges were approved by the nurses. These challenges were classified into the following groups: awareness, skills, and knowledge concerning nursing informatics (n=3), teaching and learning (n=8), information and communication security (n=3), technical and technological (n=3), financial and economic (n=3), organizational (n=6), individual (n=2), and nursing duties (n=4) challenges.

**Conclusion:** This research revealed several challenges that prohibit nursing informatics implementation. This technology can be implemented successfully by designing a suitable model that integrates the required technical, human, and structural factors.

**Keywords:** Nursing, Nursing Informatics, Information Technology, Medical Informatics, Delphi Technique

## Introduction

In contemporary healthcare systems, the adoption of Health Information Technology (HIT) and its associated systems has become an indispensable necessity for enhancing the effectiveness and safety of diagnostic and therapeutic processes in clinical settings [1, 2].

Within this new paradigm, healthcare organizations increasingly rely on digital infrastructure to manage vast volumes of clinical data, improve patient safety, and optimize operational efficiency. Consequently, it is of paramount importance to ensure that the design and implementation of these systems are beneficial to both healthcare professionals and patients. Therefore, it is important to ensure its design and implementation are useful for both healthcare professionals and patients [3, 4].

Nurses, as the primary drivers of care, lie at the epicenter of Health Information System (HIS) effectiveness, bridging the gap between digital data and clinical outcomes. In contemporary healthcare settings, the intelligent utilization of these systems by nurses not only streamlines documentation and minimizes manual entry errors but also facilitates real-time access to Electronic Health Records (EHRs). This access enables more precise patient monitoring, evidence-based clinical decision-making, and the timely implementation of safety protocols [1, 5].

Indeed, the synergy between expert nursing knowledge and health information technology infrastructure serves as a powerful catalyst; it effectively reduces unnecessary cognitive workload and mitigates medical errors, ultimately ensuring continuity of care and significantly enhancing patient safety and quality metrics within modern healthcare systems [6]. Nurses should improve their information technology (IT) competencies and be able to use IT tools to improve the outcome of healthcare services [7].

The American Nurses Association has defined nursing informatics competencies as follows: having the ability to utilize current and emerging technologies to support nursing practice, ensure patient safety and well-being, and optimize health outcomes; using IT to reduce risks and improve the performance and outcomes of healthcare services; standardizing health information and developing programs and policies to maintain ethical principles when implementing and maintaining IT in healthcare, and to use information and communication technology for principles for educational purposes [8].

Nursing informatics is a specialty that integrates nursing, computer, and information sciences. Nursing informatics includes the collection, processing, and management of data and information to support nursing practice, management of educational and research activities, and development of nursing knowledge. It also supports patients, nurses, and other healthcare professionals as well as those who are involved in medical decision-making [9, 10]. Improving patient safety and increasing the speed and accuracy of the healthcare process are the motivators of moving toward nursing informatics. Nursing informatics involves activities such as the development, implementation, and evaluation of the efficiency and effectiveness of nursing information systems such as decision support systems [11].

Despite the proven potential of nursing informatics in enhancing care quality and reducing human error, the successful implementation of these technologies extends far beyond the mere deployment of digital tools; it faces complex challenges that are inherently sociotechnical in nature. Existing evidence clearly indicates that the mere availability of technology does not guarantee success, as an imbalance between system capabilities and actual clinical needs can lead to the failure of informatics projects [12, 13].

At the human level, low digital literacy and insufficient readiness to adopt new technologies pose significant barriers to digital transformation. This deficiency is largely rooted in educational gaps during academic training, where nursing students have limited opportunities for practical engagement with informatics principles, often entering the workforce with a vague understanding of the concept and application of nursing informatics. At the organizational level, resistance to structural change, the prevailing culture within clinical units, and a lack of continuous support and training programs in the workplace have caused technology—rather than facilitating processes—to be sometimes perceived as a source of increased cognitive load, thereby reducing the time available for direct patient care. A precise articulation of these multifaceted interactions among human resources, organizational structure, and technological tools is an essential step in identifying the barriers to establishing efficient systems and in developing intervention strategies to align the nursing workforce with the evolving landscape of modern healthcare [12-14].

Although nursing informatics is a rapidly developing field worldwide, its implementation in Iran and its potential challenges are not sufficiently studied. Therefore, healthcare providers need to be acquainted with this field [15]. Developing a national nursing electronic system through the active participation of nurses in all stages of development is a small but successful step towards the effective use of informatics in nursing [16].

Given the pivotal role of nursing informatics in advancing nursing care, the existing gap between the theoretical potential of nursing informatics and its operational realities in the country, and the dearth of research addressing its implementation and associated challenges in Iran, this study was designed and

conducted to identify the challenges of nursing informatics from the perspective of nursing faculty members at Birjand University of Medical Sciences.

## Materials & Methods

This applied study was conducted in three phases to examine the challenges of nursing informatics from the perspective of the academic staff at Birjand University of Medical Sciences. These phases were as follows: 1- a systematic review, 2- classification of nursing informatics challenges, and phase 3- Validation of nursing informatics challenges using a two-step Delphi method.

### Systematic review

### Study design

This study was conducted and the results were reported in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).

### Information sources

A systematic review was conducted in the PubMed, Scopus, and Web of Science databases without time limitation until May 24, 2024. The search was done using two sets of keywords related to nursing informatics concepts (nursing informatics, nursing information) and challenges (limitation, barrier, challenge). MeSH terms are shown in bold (Table 1). To form the search strategy, two researchers combined the keywords related to "nursing informatics" and "challenge" (Table 1), restricting the results to title and abstract.

**Table 1. Search strategies for different databases**

| Database | Search strategy | Numbers |
|---|---|---|
| **PubMed** | (("**nursing informatics**"[ Mesh terms] OR "nursing informatics"[Title/Abstract] OR "nursing information" [Title/Abstract]) AND (limitation*[Title/Abstract] OR barrier*[Title/Abstract] OR "challenge*"[Title/Abstract])) | 308 |
| **Scopus** | (TITLE-ABS-KEY ("nursing informatics") OR TITLE-ABS-KEY ("nursing information") AND TITLE-ABS-KEY (limitation*) OR TITLE-ABS-KEY (barrier*) OR TITLE-ABS-KEY (challenge*)) | 387 |
| **Web of Science** | ((TS=("nursing informatics") OR TS=("nursing information")) AND (TS=("limitation*") OR TS=("barrier*") OR TS=("challenge*"))) | 203 |

### Selection criteria

Relevant studies were selected based on the following inclusion and exclusion criteria: The inclusion criteria included original research articles, studies published in English, and studies that focused on the challenges, limitations, and barriers of nursing informatics. Exclusion criteria were: review articles, meta-analyses, theses, conference abstracts, letters to the editor, critical articles (commentaries), systematic review protocols, articles in a language other than English, studies that their full texts were unavailable for data extraction, and studies unrelated to the objective of the study

### Study selection

All identified studies were entered into EndNote ver. 20 to remove any potential duplicates. After removing duplicates, the title and abstract of the remaining studies were examined according to the inclusion criteria. Then, the full texts of the articles were evaluated to ensure that the inclusion and exclusion criteria of the study were met. The titles and abstracts of all articles were screened by two researchers to identify articles related to the research objectives. To make the final decision about the selection of relevant studies, any disagreements were resolved by discussion between the authors based on the full text of the articles.

### Quality Assessment

The quality of the articles was assessed by two authors independently using the McMaster Critical Review Checklist [17] and studies with medium and high levels of quality were included in the review. Then, a third author examined the included papers to ensure the reliability of the study quality assessment.

### Classification of the nursing informatics challenges

Upon reviewing the categories provided by previous studies [18, 19], the challenges of nursing informatics were discussed in a focus group meeting with the presence of 6 specialists, having nursing, health information management, and medical informatics with at least 5 years of experience.

### Validation of nursing informatics challenges using two rounds of the Delphi technique

Nursing informatics challenges were validated using two rounds of the Delphi technique. To validate the challenges, a checklist was developed by researchers, and its content validity was confirmed by six specialists with relevant backgrounds in health information management (n=2), medical informatics (n=2), and nursing (n=2). The responses to the questions in this study were based on a five-point Likert scale with the following options: 1=little, 2=very little, 3=somewhat, 4=much, and 5=very much. At the end of each classification, a space was designed for extra challenges suggested by the specialists. In this study, 27 nursing faculty members of Birjand University of Medical Sciences provided their opinions about these challenges. Demographic information of these participants is presented in Table 2.

**Table 2: Demographic information of the participants in the Delphi technique**

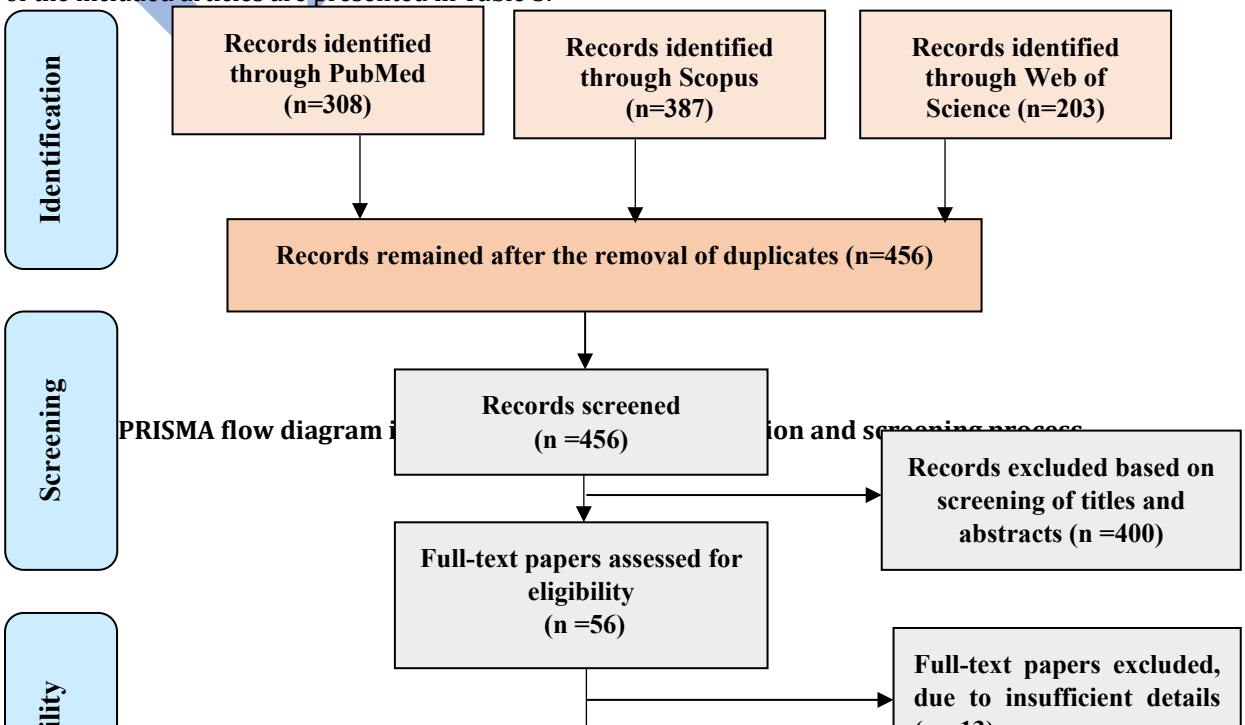
| Characteristic | | Number of Participants (%) |
|---|---|---|
| Sex | Male | 9 (35%) |
| | Female | 17 (65%) |
| Age | 28-38 | 14 (54%) |
| | 39-48 | 9 (35%) |
| | 49-58 | 3 (11%) |
| Educational level | MSc | 20 (77%) |
| | Ph.D. | 6 (23%) |
| Place of work | Birjand | 5 (19%) |
| | Tabas | 7 (27%) |
| | Qaem | 9 (35%) |
| | Ferdows | 5 (19%) |
| Work experience | ≥10 | 13 (50%) |
| | 11-20 | 11 (42%) |
| | 21-30 | 2 (8%) |

After each step, the responses were analyzed using descriptive statistics (frequency and percentage) in Microsoft Excel 2019. Items that received more than 75% of the scores in the first round of Delphi were considered for inclusion in the nursing informatics challenges. The items with scores between 50 and 75% were included in the second round of the Delphi technique and items with a score below 50% were removed. The second round of Delphi was conducted using another checklist that was designed to apply the suggestions collected in the first round and to reach an agreement. This checklist was structurally similar to the one used in the first round, with one difference. The checklist in the second round did not include any spaces for extra suggestions.

## Findings

### Systematic review

Initially 898 articles were retrieved from three databases. After removing duplicate articles (n=442) and reviewing the titles and abstracts of the retrieved articles, 56 articles were selected for the final review. After applying the inclusion and exclusion criteria, 24 relevant articles remained for extracting nursing informatics challenges. The details of the search strategy are presented in Figure 1 and the specifications of the included articles are presented in Table 3.




**PRISMA flow diagram i ion and s**

**Table 3: Characteristics of the included studies in systematic review phase**

| Author name | Year | Country | Study objective |
|---|---|---|---|
| Saranto, K. [20] | 1998 | Finland | To describe the views and goals of nursing faculty members concerning information technology education and to examine how nursing educators integrate computer courses into basic nursing education. |
| Hasna, F. [21] | 2009 | United States | Applications of informatics in the United States and Jordan with a focus on nursing roles in informatics and the ethical challenges of these applications. |
| Foster, J [22] | 2015 | Australia | Exploring the nursing informatics and e-health in Australia. |
| Fetter, M.S. [23] | 2009 | United States | Improving the access of nursing students to information technology and enhancing their relevant skills. |
| Jeon, E. [24] | 2016 | South Korea | Investigating the current status of nursing informatics education, educational contents, faculty effectiveness, barriers, and supports in Korea. |
| Peltonen, L.M. [25] | 2019 | Finland | Exploring the opportunities and challenges of nursing informatics in a panel at the 14th International Congress of Nursing and Health Informatics. |
| Bove, L.A. [26] | 2023 | United States | Determining the level of nursing faculty informatics competencies and to learn about barriers faculty find in teaching informatics. |
| Chauvette, A. [27] | 2022 | Canada | Exploring nursing faculty experiences in integrating digital tools to support undergraduate students' learning and development of nursing informatics competencies. |
| Gonen, A. [28] | 2014 | United States | Investigating the correlation between the attitude of nursing students with variables such as self-efficacy, threat, challenge, and innovation. |
| Bove, L.A. [29] | 2020 | United States | Updating the 2013 status report on the integration of informatics in nursing. |
| Marin, H.F. [30] | 2010 | Brazil | Integration of Informatics education in Nursing programs at the undergraduate and graduate levels in southern Brazil. |
| Park, H.A. [31] | 2002 | South Korea | Investigating the role of nursing informatics in professional organizations, education, research, clinical practice, and professional development in Korea. |
| Brennan, P.F [32] | 1998 | United States | Setting a national research agenda in nursing informatics. |
| Gassert, C.A. [33] | 1998 | Unites States | Increasing the readiness of nurses to use and develop technologies for information management. |
| Honey, M.L. [34] | 2017 | United States | Investigating nursing informatics competencies required to enter practice. |
| Travis, L.L. [35] | 1994 | United States | Determining the effects of an undergraduate nursing informatics curriculum on students' knowledge and attitudes. |
| Liu, C.H. [36] | 2015 | Taiwan | Examining the experiences of national institutions and proposing initiatives to help the growth and development of nursing. |
| Lokmic-Tomkins, Z. [37] | 2024 | Australia | To report findings from an international participatory workshop exploring preregistration informatics implementation experiences. |

| | | | |
|---|---|---|---|
| Carrière, R., A. [38] | 2016 | Canada | The current landscape of nursing Informatics and the experience of nurses concerning the selection of this career, opportunities, and challenges. |
| Cassey, M.Z. [39] | 1994 | United States | Projecting the future: trends influencing nursing informatics. |
| Cho, C.S. [40] | 2009 | Taiwan | Using Kurt Lewin's change theory to examine the development of nursing informatics in Taiwan. |
| Charters, K.G. [41] | 2003 | United States | Investigating nursing informatics, outcomes, and quality improvement. |
| Kleib, M. [42] | 2022 | Canada | To explore nursing students' self-perceived nursing informatics competency and preparedness in digital health, describe learning opportunities and barriers and facilitators to developing informatics competency. |
| Livesay, K. [43] | 2023 | Australia | To explore the sociotechnical challenges that nurses encountered in using digital health services implemented during the pandemic and, accordingly. |

The oldest and newest studies were conducted in 1994 and 2024, respectively (Table 3). In terms of the location of the study, 45.8% of the studies were conducted in the United States, and the rest were carried out in Canada (12.5%), Australia (12.5%), Finland (8.3%), Taiwan (8.3%), South Korea (8.3%), and Brazil (4.3%).

**Classification of nursing informatics challenges**

During the focus group meeting, nursing informatics challenges were classified into 8 groups and 33 sub-groups. These groups include challenges related to awareness, skills, and knowledge of people concerning nursing informatics, training and learning challenges, information and communication security, technical and technological issues, financial-economic issues, organizational factors, individual aspects, and nursing duties.

**Validation of nursing informatics challenges using two rounds of Delphi**

A total of 33 challenges were examined by the specialists in the first round of the Delphi. Twenty-seven of these items (score above 75%) were verified and one challenge "sense of threat and fear in using computers" from the group of individual aspects" were removed (score below 50%). The following four items received the required score for entering the second round of Delphi: "disagreement of educators about the informatics competencies required for nurses" from the group of organizational factors", "unpreparedness of nurses to deal with information technology" from individual aspects, "variation in search strategies due to scattered information" from the group of nursing duties" (score between 50 and 75%). The challenge of "lack of knowledge regarding the effectiveness of nursing informatics", which was added by the participants to the group of teaching and learning challenges, also entered the second round of the Delphi. Four out of these five items were confirmed in the second round of the Delphi, and the item "scattered information" from the group of nursing duties was removed (Table 4). Therefore, after completing the two rounds of the Delphi, 32 challenges were approved by specialists. These challenges were classified into the following groups (Table 5): Challenges related to insufficient awareness, skills, and knowledge related to nursing informatics (n=3), teaching and learning challenges (n=8), information and communication security concerns (n=3), technical and technology issues (n=3), financial-economic issues (n=3), organizational factors (n=6), individual aspects (n=2) and obstacles related to nursing duties (n=4).

**Table 4: Challenges of nursing informatics from the viewpoint of specialists (the first and second rounds of the Delphi)**

| Categories of Challenges related to: | Number of challenges | First Round of Delphi | | | | | Second Round of Delphi | | | | Final Number of challenges |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | <50% | 50-75% | 75%< | Rejected challenges | Suggested challenges | <50% | 50-75% | 75%< | Rejected challenges | |
| Awareness, skills, and knowledge concerning nursing informatics | 3 | 0 | 0 | 3 | 0 | None | 0 | 0 | 0 | None | 3 |
| Training and Learning | 7 | 0 | 0 | 7 | 0 | Lack of awareness regarding the effectiveness of nursing informatics | 0 | 0 | 1 | None | 8 |
| Information and communication security | 3 | 0 | 0 | 3 | 0 | None | 0 | 0 | 0 | None | 3 |
| Technical and technological issues | 3 | 0 | 0 | 3 | 0 | None | 0 | 0 | 0 | None | 3 |
| Financial and economic issues | 3 | 0 | 0 | 3 | 0 | None | 0 | 0 | 0 | None | 3 |
| Organizational factors | 5 | 0 | 1 | 4 | 0 | Disagreement among educators about the informatics competencies required for nurses | 0 | 0 | 1 | None | 5 |
| Individual aspects | 3 | 1 | 1 | 1 | Sense of threat and fear in using computers | Unpreparedness of nurses to deal with information technology | 0 | 0 | 1 | None | 2 |
| Nursing duties | 5 | 0 | 2 | 3 | 0 | Variation of search strategies due to scattered information | 1 | 0 | 1 | Scattered information | 4 |

**Table 5: The final challenges from the viewpoint of nursing faculty members**

| Challenges | Subgroups | Frequency | Mean | Percentage |
|---|---|---|---|---|
| Awareness, skills, and knowledge regarding nursing informatics | Low computer skills | 21 | 0.80 | 80.77 |
| | Insufficient and basic knowledge of programming | 21 | 0.80 | 80.77 |
| | Limited skills and insufficient literacy of information and communication technology among students and faculty members | 22 | 0.84 | 84.62 |
| Teaching and learning | Lack of training concerning applications, software, and nursing informatics during the education period | 20 | 0.76 | 76.92 |
| | Nursing informatics incompetency of nursing faculty members | 21 | 0.80 | 80.77 |
| | Lack of standardization for nursing informatics competencies | 21 | 0.80 | 80.77 |
| | Inadequate nursing informatics training for nurses | 22 | 0.84 | 84.62 |
| | Insufficient knowledge of nursing faculty members about the nursing informatics curriculum | 21 | 0.80 | 80.77 |
| | Lack of nursing informatics faculty members | 22 | 0.84 | 84.62 |
| | Limited informatics content in nursing curricula | 21 | 0.80 | 80.77 |
| | Unawareness regarding the effectiveness of nursing informatics | 21 | 0.80 | 80.77 |
| Information and communication security | Concerns about confidentiality and information security | 21 | 0.80 | 80.77 |
| | Privacy concerns | 20 | 0.76 | 76.92 |
| | Concerns about information sharing | 21 | 0.80 | 80.77 |
| Technical and technological issues | Poor user-friendliness | 20 | 0.76 | 76.92 |
| | Rapid changes in information technology | 20 | 0.76 | 76.92 |
| | Inappropriate and unsupported software | 21 | 0.80 | 80.77 |
| Financial and economic issues | Lack of facilities | 22 | 0.84 | 84.62 |
| | High education costs | 21 | 0.80 | 80.77 |
| | Limited support for financial investments in nursing informatics | 22 | 0.84 | 84.62 |
| Organizational factors | Failure to understand the importance of nursing informatics by professional nursing organizations and nursing managers | 22 | 0.84 | 84.62 |
| | Disagreement among educators about the informatics competencies required for nurses | 20 | 0.76 | 76.92 |
| | Ignoring the importance of data standards by professional nursing organizations | 21 | 0.80 | 80.77 |
| | Lack of chief nursing informatics officer roles | 22 | 0.84 | 84.62 |
| | Failure to understand the importance of a shared language by professional nursing organizations | 20 | 0.76 | 76.92 |
| | Failure to understand the importance of nursing classification systems by professional nursing organizations | 22 | 0.84 | 84.62 |
| Individual aspects | Lack of time to learn current nursing informatics trends | 25 | 0.96 | 96.15 |
| | Unpreparedness of nurses to engage in information technology activities | 20 | 0.76 | 76.92 |

| | | | | |
|---|---|---|---|---|
| Nursing duties | Division of nursing tasks to use nursing informatics in nursing management and care | 20 | 0.76 | 76.92 |
| | How to search for information | 21 | 0.80 | 80.77 |
| | How to document patient data | 21 | 0.80 | 80.77 |
| | Limited reporting | 20 | 0.76 | 76.92 |

**Discussion**

Nursing informatics as emergent technology supports decision-making in nursing and improves and accelerates virtual learning and e-health. The main objective of this research was to investigate the challenges of nursing informatics from the perspective of the nurses working at Birjand University of Medical Sciences. The challenges found by this study were classified into eight main categories including awareness, skills, and knowledge concerning nursing informatics, teaching and learning, information and communication security, technical and technological, financial and economical, organizational, individual, and nursing duties challenges.

In this regard, the research results of Darwish et al. showed that nursing informatics is a new field in Iran with 15 years of history, while it has a history of 60 years in a pioneer country such as the United States. Based on a comparative study, nursing informatics in Iran has the lowest development compared to countries including the United States, England, Canada, Australia, and Taiwan. In addition, in terms of factors such as management and leadership, education and training, communication and cooperation, informatics design, information technology, policymaking, and culture in nursing informatics, the status of nursing informatics in Iran is beyond its status in other mentioned countries under review [44]. On the other hand, several nursing minimum data sets have been developed in countries such as the United States, Belgium, Switzerland, Australia, Netherlands, Canada, Finland, Sweden, Brazil, and Thailand. Since no nursing minimum data set is developed in Iran, different healthcare centers collect their own set of data [45]. A study by Ahmadi et al. found that each of the countries they investigated had its own, localized nursing data sets. However, there is no universal standard on nursing data elements that are essential to be collected in electronic health records in Iran. Given the importance of nursing data in providing care, it has been suggested to create a nursing minimum data set for Iran [45].

In a similar study Valizadeh et al., categorized the challenges and obstacles of nursing information systems into the following six groups: 1) noncompliance of nursing programs with nursing tasks due to the lack of standard nursing terminology, and lack of minimal nursing data set, 2) lack of an appropriate and comprehensive classification system, 3) Lack of nursing clinical decision support systems, 4) obstacles related to nursing documentation including the lack of formatting and grouping of reports, computer and technical problems, and information confidentiality and security issues 5) individual aspects, 6) and organizational factors [46]. Many of the challenges identified in that research are reflected in our study, though differences may be due to certain organizational and individual factors.

Consistent with the results of a study by Varzeshnejad et al., inadequate awareness, skill, and knowledge were one of the most important challenges raised in our research. Varzeshnejad's results indicated implementing nursing informatics increases pharmaceutical knowledge and knowledge of nurses concerning nursing processes. The content analysis of the qualitative findings in that study resulted in the identification main themes of providing quality care, improving the documentation process, professional development, continuous education and learning, combining theory and practice in nursing, and human and equipment barriers (5). A prior study by Olajubu et al., found that nurses rated their competence in using nursing informatics at the level of "disabled". This pattern of competency was consistent across all levels and healthcare domains [47]. Our results confirm the findings of Hwang and Park's study which showed that most of the respondents deemed their informatics competence below average. This finding, which is not unexpected, may be related to respondents' insufficient knowledge about nursing informatics [48].

The teaching and learning issues along with individual aspects were the second challenges that were identified in our research. In line with this result, in a previous relevant study, individual aspects, level of education, age, past work experience, association of errors to insufficient nurse training, low computer knowledge, resistance and anxiety of nurses, repetitive work, negative attitude towards nursing information systems were also mentioned as personal and educational-related problems [49]. Based on these results, for implementing a nursing documentation system, it is necessary to involve nurses in all stages of the development including planning, analysis, design, implementation, and maintenance of the system. The involvement of nurses in the development helps to transfer their expectations and needs to the development team. In addition, it increases their positive attitude toward the new system and lowers their resistance to adopting it [50]. Another study highlighted that despite the significant progress of digital technology, it is still challenging to integrate it into nursing practice. A constant concern is that nurses are

not able to keep up with the rapid changes in digital technologies and their impact on society. This limits the potential benefits it can bring to nursing and patient care [51].

The technical and technological issue was also one of the main challenges recognized by the present research. Other studies reported challenges such as computer and technical problems, power outages, viruses, low system speed, limited access to technical support, occurrence of new types of errors, and insufficient equipment and computers. In addition, most computer programs in the nursing clinical environment do not have the capability of processing information in all or most aspects of care. Therefore, it is important to perform interventions such as software hardware and network upgrades and provide up-to-date computers in clinical environments to ensure the infrastructure and capabilities required to implement nursing informatics [52].

According to the results of the current study, the organizational, economic, and financial factors constitute another group of challenges. Other studies identified organizational factors including position hierarchy, workload, communication patterns, work setting, management philosophy, high costs, shortage of nursing personnel in clinical departments, and high cost of implementing and operating IT systems [53]. Yazdi Feizabadi et al. in another study enumerated the following organizational challenges: lack of integrated nursing decision support systems, system inflexibility leading to complex and time-consuming processes, unstructured nursing data disqualifying them from being used for evidence-based decision-making, and inaccessibility of the required data and knowledge [54]. A study conducted in Nigeria has reported that excessive workload and lack of personnel limit the use of nursing informatics. However, this is predictable for a developing country like Nigeria due to a common shortage of personnel in most health centers [47]. According to other research, the low progress of nursing in the information technology domain globally has been somewhat due to poor leadership, lack of investment, and uncertainty about the next steps of the nursing profession toward digital technology. This challenge is exacerbated by the global diversity of the nursing profession, including unequal access to resources such as technological infrastructure and expertise. There are huge differences between countries and geographic regions in terms of digitization of health care processes, access to the Internet, and transparency of health information processes [55].

The information and communication security concern was also one of the challenges raised in our research. Other studies also pointed out challenges such as confidentiality and security concerns related to patient information, creation of invalid data fields, fake documentation, lack of law concerning the protection of patients' data and information, lack of monitoring over electronic data [56].

Obstacles related to nursing duties were also the last challenge raised in our research. To adapt information-based programs to nursing duties, it is necessary to develop a standard terminology and minimum data set for nursing before the digitalization of nursing records. Moreover, adding a subject concerning the use of nursing information systems in educational programs can improve the adoption of IT in nursing. It is suggested that Iranian nursing organization, nursing faculty members, and health information management specialists who are specialized in the domains of nursing and information management, contribute to the development of the nursing minimum data set for Iran [57].

**Conclusion**

The research suggests overcoming challenges in nursing informatics implementation through a tailored model integrating technical, human, and infrastructural elements. Global initiatives empowering nurses in IT can enhance informatics tool utilization, improving nursing services, patient care, and outcomes. Establishing an academic nursing informatics major is proposed to design and implement systems aligned with nursing responsibilities.