



Nursing Informatics Confidence in Digitally Transforming Hospitals

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Abstract

Digital transformation is reshaping hospital nursing through electronic health records, computerized documentation, medication-management systems, clinical decision support, electronic communication, and increasingly data-intensive care processes. The effectiveness of this transformation depends not only on technological infrastructure but also on nurses' confidence in using digital systems safely, efficiently, and meaningfully within clinical workflows. The present study develops a simulation-based framework for examining nursing informatics confidence during hospital digital transformation.

The model conceptualizes confidence as a multidimensional professional capability incorporating computer literacy, information management, electronic documentation, clinical information-system use, data-security awareness, workflow adaptation, and confidence in solving routine technology-related problems. A hypothetical sample of 360 hospital nurses was constructed to evaluate relationships among structured informatics training, leadership support, digital workflow exposure, and self-reported confidence. Because no original hospital dataset was provided, all numerical outcomes are synthetic and intended exclusively for methodological demonstration. The simulated results indicate that nurses exposed to structured informatics training and stronger leadership support demonstrate higher modeled confidence than nurses receiving minimal preparation. Mean confidence increased from 51.8 among nurses with limited structured preparation to 76.4 among those receiving intensive training and workflow support.

Earlier research established differentiated nursing informatics competencies across levels of practice, while subsequent studies demonstrated the continuing importance of computer literacy, informatics knowledge, information-management competence, EHR usability, and targeted education. The study concludes that digitally transforming hospitals should treat nursing informatics confidence as an organizational capability requiring continuous education, usable systems, bedside involvement in implementation, responsive technical support, and supportive nursing leadership rather than as an individual nurse's responsibility alone.

Keywords: nursing informatics; digital transformation; hospital nursing; electronic health records; digital confidence; informatics competency; nursing education; health information technology; digital readiness; clinical workflow



1. Introduction

Hospitals have progressively incorporated digital technologies into clinical documentation, medication administration, laboratory and diagnostic reporting, patient monitoring, communication, scheduling, decision support, and quality management. Nurses interact with many of these systems continuously because a substantial proportion of bedside clinical information is generated, interpreted, updated, and communicated through nursing practice. Digital transformation therefore changes not only how nurses document care but also how they retrieve information, coordinate with multidisciplinary teams, recognize clinical trends, communicate risk, and maintain continuity across shifts. Staggers, Gassert, and Curran's foundational work demonstrated that nursing informatics requirements vary by level of practice and include combinations of computer skills, informatics knowledge, and informatics skills rather than a single technical capability.

The increasing technological complexity of hospital care makes confidence an important dimension alongside objectively measured competence. A nurse may possess basic computer familiarity yet remain uncertain when navigating an unfamiliar electronic health record, interpreting digital alerts, retrieving historical information, documenting complex interventions, correcting data-entry problems, or responding when a system behaves unexpectedly. Confidence in this context should not be understood as uncritical trust in technology. Appropriate informatics confidence combines the ability to use a system with awareness of its limitations, professional responsibility for data accuracy, willingness to seek assistance, and capacity to recognize when digital information conflicts with clinical observation. The Self-Assessment of Nursing Informatics Competencies Scale developed and psychometrically evaluated by Yoon and colleagues illustrates the long-standing importance of systematically measuring perceived informatics capabilities rather than assuming them from computer exposure alone.

International work has increasingly emphasized the breadth of required nursing informatics capabilities. Hübner and colleagues' TIGER-based recommendation framework identified 24 core competency areas across major nursing roles, illustrating how informatics extends beyond routine device operation into information and knowledge management, communication, quality, ethics, and organizational processes. Kinnunen and colleagues similarly described nursing informatics competencies as fundamental across direct care, administration, and education. These frameworks are particularly relevant during hospital transformation because nurses are not merely users of completed digital systems; their work processes are frequently altered by implementation decisions, interface design, documentation requirements, and data-flow architecture.

Evidence also indicates that technology quality and workplace context influence nurses' experience of digital systems. Kutney-Lee and colleagues examined comprehensive EHR adoption, nurse-reported usability, quality of care, and the hospital work environment and found that advanced technology adoption interacts with organizational context rather than operating independently from it. Farzandipour and colleagues' hospital study reported substantial gaps in self-assessed nursing informatics competencies, particularly within practical informatics skills, reinforcing the need for structured educational planning. These findings challenge the assumption that repeated exposure to hospital computers automatically produces sufficiently confident and competent digital nursing practice.

The present study therefore investigates nursing informatics confidence in digitally transforming hospitals through a simulation-based analytical framework. The study focuses on structured training,



practical workflow exposure, leadership support, technical assistance, and involvement in digital change as possible determinants of confidence. Since no original participant dataset was supplied, the manuscript does not claim real prevalence estimates or causal intervention effects. Instead, it develops a transparent model that could be tested through future multicenter hospital research and provides a structured basis for evaluating whether digital transformation is accompanied by corresponding development of the nursing workforce.

2. Objectives of the Study

2.1 Assessment of Nursing Informatics Confidence

The first objective is to develop a multidimensional approach for assessing how confident hospital nurses feel when using digital technologies in routine clinical practice. Informatics confidence is defined to include more than the ability to log into an electronic system or enter routine observations. It encompasses information retrieval, electronic documentation, safe data handling, interpretation of digital information, navigation of clinical systems, response to system problems, and effective incorporation of digital tools into patient-care decisions.

This objective reflects the longstanding competency distinction established by Staggers and colleagues between computer skills, informatics knowledge, and informatics skills. It also recognizes that informatics competencies have increased in complexity as clinical systems have expanded. Forman, Armor, and Miller's 2020 review emphasized the need to reconsider nursing informatics preparation in relation to contemporary clinical practice and nursing education.

2.2 Examination of Training and Organizational Support

The second objective is to determine how structured informatics education, digital workflow exposure, leadership encouragement, and access to responsive technical support could influence nursing confidence during hospital digital transformation. The theoretical model assumes that confidence is more likely to develop through repeated guided practice and supportive implementation than through one-time software orientation.

Training is treated as a clinical workforce-development intervention rather than an administrative requirement. Jouparinejad and colleagues' 2020 interventional study among critical-care nurses found that an educational program improved nursing informatics competency, supporting the use of systematic learning interventions when hospitals expect nurses to adopt increasingly complex health information technology.

2.3 Development of a Nurse-Centered Digital Transformation Model

The third objective is to position nurses as active participants in digital transformation rather than passive end users. Nurses possess detailed knowledge of bedside workflows, communication dependencies, documentation burden, medication processes, handoffs, interruptions, and patient-safety vulnerabilities. Their participation can therefore contribute to identifying where a digital workflow supports clinical work and where it creates unnecessary complexity.

The proposed model accordingly considers participation in system implementation, feedback mechanisms, clinical informatics leadership, unit-based digital champions, and psychologically safe



reporting of technology problems as contributors to digital confidence. This interpretation is consistent with evidence that the nursing work environment influences perceptions of EHR usability and care quality.

3. Review of Literature

3.1 Evolution of Nursing Informatics Competency

Staggers, Gassert, and Curran provided an influential early research-based framework for nursing informatics competencies. Their Delphi work differentiated competencies across beginning nurses, experienced nurses, informatics specialists, and informatics innovators. The framework was important because it established that informatics competence should correspond to professional role and responsibility rather than applying an identical technical expectation to all nurses.

Chang and colleagues subsequently examined nursing informatics competencies required of nurses in Taiwan, adapting earlier competency work to another professional and cultural context. Their study reinforced the relevance of differentiating competency requirements and demonstrated that informatics capability must be considered within specific nursing environments. Choi and De Martinis also assessed nursing informatics competencies among undergraduate and graduate nursing students, contributing to the growing evidence that digital capability should be developed systematically before and during professional practice.

By 2018, Hübner and colleagues' TIGER initiative had expanded international discussion by establishing a recommendation framework containing 24 core competency areas for five nursing roles. The movement from basic computer skills toward broader digital-health capability is significant for digitally transforming hospitals because contemporary systems require nurses to understand information quality, clinical workflows, electronic communication, privacy, data management, and the relationship between technology and professional practice.

3.2 Measurement, Training, and Confidence Development

Measurement has been central to understanding informatics capability. Yoon and colleagues evaluated the psychometric properties of the Self-Assessment of Nursing Informatics Competencies Scale, providing a structured approach to assessing perceived nursing informatics capability. Seo and colleagues later conducted cross-cultural adaptation and evaluation of the Korean version of this instrument, demonstrating continued interest in reliable self-assessment across different health-care environments.

Self-assessment nevertheless has limitations. Nurses may underestimate unfamiliar capabilities or overestimate skills that have not been objectively tested. A robust hospital assessment strategy should therefore combine perceived confidence with practical indicators such as task completion, documentation quality, problem-solving capability, training participation, support requests, and observed workflow performance. Confidence remains important because technically competent professionals who feel chronically uncertain may avoid advanced functions, depend excessively on colleagues, or experience greater difficulty when systems change.

Jouparinejad and colleagues' 2020 intervention provides particularly relevant evidence regarding modifiability. Their study examined a structured training program for critical-care nurses and reported



improvement in nursing informatics competency following education. This suggests that competency gaps identified during hospital transformation should not be regarded as fixed characteristics of the workforce. Appropriate training, guided practice, and reinforcement can become part of the implementation strategy.

3.3 Hospital Systems, Usability, and the Research Gap

Digital confidence is partly shaped by the technologies nurses are expected to use. Kutney-Lee and colleagues found that comprehensive EHR adoption was associated with more positive nurse reports of usability and quality of care and also emphasized the role of the work environment. The implication is that difficulty using a clinical system should not automatically be interpreted as inadequate user capability; poor interface design, workflow mismatch, technical instability, and organizational implementation choices can also influence the nursing experience.

Farzandipour and colleagues examined hospital nurses' self-assessed informatics competencies and found that more than half of participating nurses demonstrated relatively limited informatics capability according to their study's classification. Practical informatics skills were weaker than some knowledge dimensions. Their results illustrate why a hospital can possess sophisticated digital infrastructure while still having substantial workforce-development needs.

The remaining gap concerns the relationship between competency, confidence, and organizational digital transformation. Much earlier research evaluated informatics knowledge or skills as individual attributes, whereas transformation involves repeated system changes, altered workflows, implementation stress, training requirements, technical support, and leadership decisions. The present study therefore proposes an integrated framework in which nursing confidence emerges from interaction among professional capability, educational exposure, system usability, and organizational support.

4. Research Methodology

4.1 Research Design and Simulated Sample

The study adopts a simulation-based cross-sectional analytical design supplemented by an implementation-oriented conceptual framework. A hypothetical sample of **360 registered nurses** was constructed to represent clinical nurses employed in medical, surgical, critical-care, emergency, maternity, and specialty units within digitally transforming hospitals. The modeled sample includes nurses with varying clinical experience, previous technology exposure, informatics training, and perceived leadership support.

Because no real hospital dataset was provided, all numerical observations were generated synthetically. The analysis is intended to demonstrate how a future empirical study could evaluate nursing informatics confidence rather than estimate actual confidence levels within a particular hospital or country. A prospective real-world version could employ stratified sampling across hospital units and institutions to improve representativeness.

Relevant covariates in an empirical study would include age, nursing experience, educational qualification, clinical unit, previous EHR exposure, frequency of system use, informatics education, availability of bedside devices, participation in digital implementation activities, technical-support



accessibility, and perceived usability of hospital information systems. These variables would help distinguish individual capability from organizational and system-level influences.

4.2 Measurement Framework and Proposed Questionnaire

The primary outcome is a standardized nursing informatics confidence score covering electronic documentation, information retrieval, digital clinical communication, safe handling of patient information, routine troubleshooting, and ability to adapt when workflows or digital systems change. Previous nursing informatics literature supports evaluating computer skills, informatics knowledge, and informatics skills as related but distinct capabilities.

Five proposed questionnaire items are incorporated into the future empirical framework. They are original study-development items and have **not** been administered or psychometrically validated. Before clinical research use, they should undergo expert content review, pilot testing, reliability analysis, construct validation, and appropriate cultural or linguistic adaptation.

Table 1: Proposed Nursing Informatics Confidence Measurement Framework

Code	Proposed questionnaire item	Primary construct	Response scale
NIC-1	I can confidently retrieve and interpret the digital patient information needed for routine nursing care.	Information retrieval confidence	1 = Strongly disagree to 5 = Strongly agree
NIC-2	I can document nursing assessments and interventions accurately in the hospital's electronic system.	Electronic documentation confidence	1–5 Likert scale
NIC-3	I know how to respond appropriately when a digital system produces an error, unexpected alert, or workflow problem.	Digital problem-solving confidence	1–5 Likert scale
NIC-4	I can use digital clinical systems while maintaining patient confidentiality, data accuracy, and professional accountability.	Information-governance confidence	1–5 Likert scale
NIC-5	I feel prepared to adapt when my hospital introduces a new or substantially changed digital clinical workflow.	Digital transformation confidence	1–5 Likert scale

4.3 Training Exposure and Statistical Strategy

For simulation purposes, nurses were conceptually classified according to structured informatics preparation: limited training, moderate training, and intensive training with ongoing workflow support. Training includes supervised EHR practice, documentation exercises, information retrieval, privacy and security procedures, use of clinical decision-support functions, problem-solving scenarios, and unit-specific digital workflow practice.



A real study could apply descriptive statistics to confidence domains and use Pearson or Spearman correlation to examine associations between training exposure and confidence. Multivariable linear regression could estimate the independent contribution of training after adjusting for clinical experience, age, previous technology exposure, leadership support, system usability, and unit type. Where nurses are nested within hospital units or multiple hospitals, multilevel modeling would be preferable to account for organizational clustering.

Training should also be evaluated longitudinally rather than through attendance alone. Jouparinejad and colleagues' intervention demonstrates the feasibility of assessing informatics competency before and after educational exposure. A stronger future design could incorporate baseline assessment, immediate post-training evaluation, and follow-up after several months of routine system use.

5. Analysis

5.1 Simulated Confidence Across Training Conditions

The simulated results demonstrate a progressive association between structured preparation and nursing informatics confidence. Nurses in the limited-training condition recorded a modeled mean confidence score of 51.8 out of 100, while those receiving moderate structured preparation reached 64.7. Nurses assigned to intensive training combined with workflow support reached a mean of 76.4.

The difference should not be interpreted as a measured educational effect. It represents the central hypothesis of the proposed study: confidence is likely to be stronger when nurses receive sufficient opportunities to practice real clinical workflows rather than merely attending a brief introduction to software features. The hypothesis is supported conceptually by intervention evidence showing that nursing informatics competency can improve following structured education.

Table 2: Simulated Nursing Informatics Confidence and Digital-Readiness Outcomes

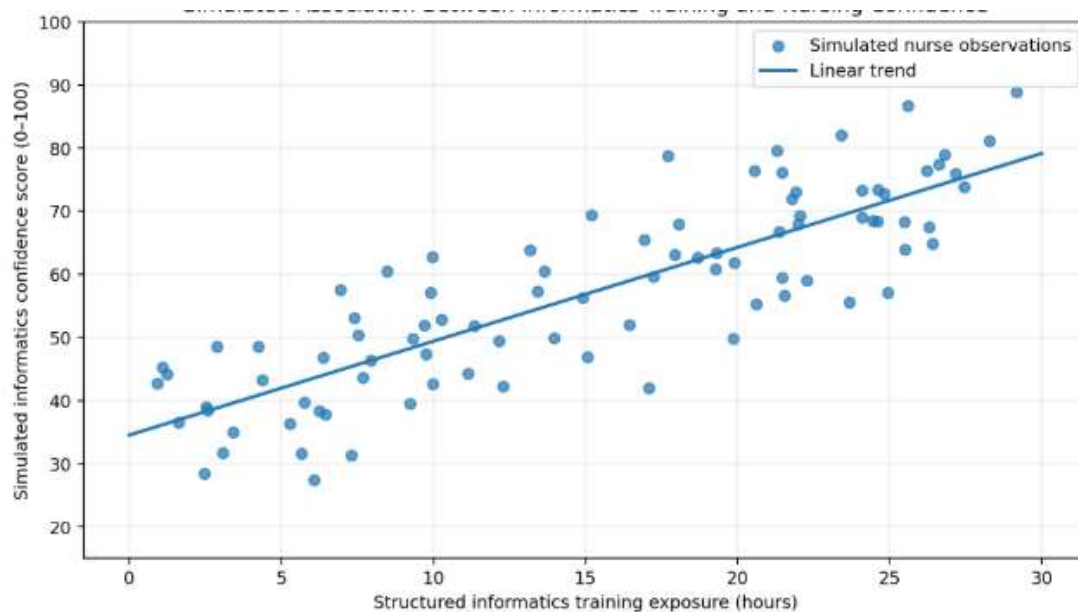
Outcome indicator	Limited preparation (n = 120)	Moderate preparation (n = 120)	Intensive training + workflow support (n = 120)
Mean informatics confidence score /100	51.8	64.7	76.4
Confident in electronic documentation	54%	71%	87%
Confident retrieving clinical information	58%	74%	89%
Confident responding to routine digital problems	37%	59%	79%
Confident with privacy and data-	61%	76%	90%

security responsibilities			
Confident adapting to changed digital workflows	39%	62%	82%
Perceive leadership as supportive of digital learning	43%	68%	86%

5.2 Training Exposure and Informatics Confidence

The simulated nurse-level dataset was also used to visualize the relationship between hours of structured informatics training and confidence. The scatter distribution shows considerable individual variation, reflecting the assumption that training is not the only determinant of confidence. Leadership support, previous digital experience, workflow usability, clinical role, and personal learning needs can influence the same outcome.

Graph 1: Simulated Association Between Structured Informatics Training and Nursing Confidence



5.3 Confidence Gaps During Digital Transformation

The largest simulated competency gap concerns response to routine digital problems. Only 37% of nurses with limited preparation are modeled as confident in responding to system errors, unexpected alerts, or workflow disruptions, compared with 79% under intensive preparation. This difference is important because digitally transforming hospitals expose nurses not only to normal system operation but also to downtime, interface inconsistencies, device connectivity problems, incomplete data, duplicated information, and workflow changes.



A second substantial gap concerns confidence in adapting to changed digital workflows. Familiarity with an existing system does not necessarily translate into readiness for a newly configured medication process, documentation template, decision-support tool, or bedside device. Digital transformation should therefore be understood as an ongoing learning process rather than a one-time transition from paper to electronic records.

Finally, the simulation indicates that perceived leadership support rises alongside confidence. This association is intentionally modeled as contextual rather than causal. Future empirical studies should test whether leaders influence confidence by protecting learning time, making training accessible, responding constructively to implementation problems, encouraging nurse involvement, and ensuring that difficulties with technology can be reported without blame.

6. Discussion

6.1 Informatics Confidence as a Clinical Workforce Capability

The study positions nursing informatics confidence as a professional capability situated between knowledge, practical skill, and organizational readiness. Digital confidence is not equivalent to general confidence with personal technology. A nurse may be comfortable using smartphones or common software yet remain uncertain when required to document legally significant clinical information, interpret decision-support alerts, manage access permissions, or recognize when electronic information is clinically incomplete.

This distinction is consistent with Staggers and colleagues' differentiated competency framework and with later literature emphasizing computer literacy, informatics knowledge, and information-management capability. Hübner and colleagues' TIGER framework further demonstrates that nursing informatics now encompasses a broad collection of competencies rather than basic computer operation alone. Digitally transforming hospitals should consequently avoid equating routine system exposure with comprehensive informatics readiness.

Confidence must also remain calibrated. Excessive confidence in poorly understood technology can create risk just as insufficient confidence can inhibit effective use. The desirable outcome is therefore competent confidence: nurses understand what a system can do, recognize limitations, verify clinically important information, preserve professional judgment, and seek assistance when uncertainty exceeds their competence.

6.2 Training, Usability, and the Nursing Work Environment

The simulated analysis suggests that structured training may be associated with stronger confidence, but the scatter pattern deliberately shows that educational exposure does not explain all variation. This is consistent with the broader sociotechnical character of digital hospital work. A well-trained nurse can still struggle with an unstable or poorly designed system, while an intuitive interface and accessible support can reduce cognitive burden for users with different experience levels.

Kutney-Lee and colleagues' study is particularly relevant because it linked EHR adoption and usability with the nursing work environment and nurse-reported quality outcomes. Digital transformation should therefore be assessed through both workforce and system indicators. When many



competent nurses encounter the same difficulty, the appropriate response may be workflow redesign or system modification rather than repeatedly retraining individual users.

Training quality also deserves greater attention than attendance. Jouparinejad and colleagues showed that a targeted educational intervention could improve nursing informatics competency. Hospitals can build upon this principle by providing scenario-based learning tied to actual unit workflows, protected practice environments, role-specific instruction, super-user support, refresher education, and targeted coaching following major system updates.

6.3 Nursing Leadership and Participation in Digital Transformation

Nursing leadership has a central role in translating technological implementation into clinical adoption. Leaders determine whether informatics education receives protected time, whether digital problems are escalated, whether feedback reaches implementation teams, and whether nurses are involved before new workflows become mandatory. These decisions influence whether digital change is experienced as collaborative clinical improvement or externally imposed administrative burden.

Participation is especially important because nurses understand the sequence and interdependence of bedside tasks. A technically functional system may still create inefficient duplication, interrupt communication, obscure clinically important information, or require documentation at a point inconsistent with real care delivery. Nurse involvement in design, testing, pilot implementation, and post-launch evaluation can reveal such problems before they become normalized. The research implication is that future studies should move beyond measuring whether nurses “accept” technology. More useful outcomes include confidence, competency, usability, workflow fit, information quality, training adequacy, leadership support, documentation burden, patient-safety reporting, and participation in implementation decisions. Forman and colleagues' 2020 review emphasized the growing complexity of informatics capabilities required in nursing education and practice. Digitally transforming hospitals therefore require an equally sophisticated workforce-development strategy.

7. Conclusion

Nursing informatics confidence is an increasingly important component of successful hospital digital transformation. As electronic records and other clinical information systems become embedded within nursing work, nurses require more than basic familiarity with computers. They need confidence in retrieving and interpreting information, documenting accurately, protecting patient data, responding to digital problems, and adapting safely when clinical workflows change.

The present simulation illustrates a plausible relationship between structured informatics preparation and nursing confidence. Under the hypothetical model, confidence increased from 51.8 among nurses with limited preparation to 76.4 among nurses receiving intensive training combined with workflow support. The accompanying scatter analysis demonstrated a positive modeled relationship between training exposure and confidence while preserving meaningful individual variability. These values are entirely synthetic and must not be represented as observed intervention effects.

The study also emphasizes that confidence cannot be developed through education alone. System usability, technical support, nursing leadership, learning time, workflow design, and nurse participation in implementation can shape whether acquired informatics knowledge translates successfully into



bedside practice. A hospital that purchases advanced technology without developing these complementary capabilities risks creating digital infrastructure without equivalent organizational readiness.

Future empirical research should test the proposed framework across multiple hospitals using validated nursing informatics competency instruments, objective performance measures, EHR usability indicators, and longitudinal assessment before and after major digital implementations. Such evidence can help hospitals identify where confidence gaps originate and determine whether the appropriate response is additional education, workflow redesign, leadership intervention, technical improvement, or a combination of these strategies. Digital transformation will be most sustainable when nurses are treated not simply as users of hospital technology but as knowledgeable clinical partners in its design, implementation, evaluation, and continuous improvement.

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