TELEHEALTH AND MEDICINE TODAY

ORIGINAL RESEARCH

Digital Transformation in the Credentialing Process: Development of an E-Credential Application for Nurses and Midwives at a Vertical Hospital

Deny Prasetyanto, BSN, MN[1], Amelia Ganefianty, BSN, MN, Ph.D[2], Neneng Kurniati, BSN[2], Titin Mulyati, BSN, MN[2], Sri Yulia Rahayu, BSN, MN[2], Ranti Haryati, BSN[2], Romanian Romanian, BSc[2], Hafsa Hafsa, BSN, MN[3], Meitha Roosmeilany, BSN, MN[4], and Oded Sumarna, BSN, MN[1]

[1]Sekolah Tinggi Ilmu Kesehatan Fatmawati, Bandung, Indonesia; [2]Nursing Committee of Hasan Sadikin Hospital, Bandung, Indonesia; [3]Directorate of Education and Training of Hasan Sadikin Hospital, Bandung, Indonesia; [4]Nursing Service Team of Hasan Sadikin Hospital, Bandung, Indonesia

Corresponding Author: Amelia Ganefianty, Email: ganefianty@gmail.com

DOI: https://doi.org/10.30953/thmt.v11.628

Keywords: digital health, e-credentialing, electronic credentialing, hospital administration Indonesia, nurses, midwives, Post-Study System Usability Questionnaire, PSSUQ

Abstract

Background: Credentialing nurses and midwives is essential to ensure professional competence and patient safety. However, conventional manual processes are often inefficient and administratively burdensome. Digital transformation offers an opportunity to streamline credentialing through electronic systems.
Objective: The authors evaluated the usability and user satisfaction of an electronic credential (e-credential) application implemented for nurses and midwives at a vertical hospital in Indonesia.
Methods: A quantitative descriptive study was conducted involving 166 nurses and midwives who completed the credentialing process following competency level upgrades across nine clinical peer groups. System usability and user satisfaction were assessed using the Post-Study System Usability Questionnaire (PSSUQ). Descriptive statistics were used to analyze item-level and domain-level scores. Brief interviews and open-ended questions were conducted to clarify user experiences and identify technical improvement needs.
Results: The e-credential application demonstrated good usability and high user satisfaction. The overall mean PSSUQ score was 1.87 ± 0.58, indicating favorable user perceptions. Mean scores for the System Usefulness, Information Quality, and Interface Quality domains were 1.83 ± 0.55, 1.90 ± 0.62, and 1.86 ± 0.59, respectively. Users perceived the system as easy to learn, efficient, and supportive of credentialing tasks, with reduced administrative workload through paperless document management. Supplementary feedback highlighted the need for expanded access outside the hospital network and improvements to the document revision feature.
Conclusion: The e-credential application demonstrated strong usability and was well received by nurses and midwives, supporting a more efficient, structured credentialing process. Further system refinement and broader implementation may enhance the flexibility and sustainability of digital credentialing in hospital settings.

Submitted: September 8, 2025; Accepted: January 1, 2026; Published: March 20, 2026

In the era of rapidly developing technology, digitalization has become necessary in various sectors, including the health sector.[1] One area that requires digital innovation is the credentialing process of hospital nursing staff. Nursing staff credentialing is essential to ensure staff qualifications, competence, and integrity before providing health services to patients.[2] The safety and quality of health services depend heavily on the thoroughness and accuracy of this process.

In many hospitals, the credentialing process is still carried out manually, involving the collection of physical documents, repeated administrative checks, and

time-consuming qualification verification.[3] This manual process is often inefficient and prone to errors, such as late verification or loss of documents, which can lead to a shortage of staff ready to serve. In addition, this process is prone to human error, such as inaccurate data recording and the risk of loss or damage to physical documents.[4]

In addition, manual processes pose challenges related to data security and privacy, given that physical documents are vulnerable to loss or theft, which can lead to privacy violations and data breaches.[4] Increasingly stringent regulations regarding personal data protection make this issue even more urgent to address. Digital transformation in the credentialing process offers significant advantages, such as increased efficiency and accuracy. Implementing a digital-based credentialing system can automate the verification and collection of documents in real time, reducing the time and costs.[5] This process can reduce human error and facilitate more structured and secure management of credential information. Digital systems also allow easier and safer access to information through digital platforms equipped with high-security features, such as encryption and user authentication.[6]

Here, the author develops and implements a digital-based credentialing process in a hospital. This study analyzes the current credentialing process to identify the needs and challenges and design an appropriate digital system. This system is designed to be easy to use by all parties involved, including nursing staff and hospital administration.

The effectiveness of this system in actual hospital conditions was also assessed, with trials involving various related parties to ensure smooth implementation. In addition, data security and privacy and ensuring that the system complies with applicable personal data protection regulations will be a primary concern. User acceptance of this new system will be considered, with training and support so that users can adapt to the developed digital system. It is anticipated that the results of this study can provide a comprehensive and sustainable solution to the challenges of nursing staff credentialing in the digital era. It is anticipated that the results will improve human resource management in hospitals and support efforts to improve the quality of health services. It is also the goal that implementing a digital-based credential system will bring significant changes to the health sector, increasing the nursing staff credentialing process's efficiency, accuracy, and security.

Methods

Population and Sample

The study population consisted of 1,182 nurses and midwives employed at hospitals that had adopted a digital-based credentialing system. A purposive sampling technique was used to recruit participants who completed the credentialing process using the e-credential application.

The minimum sample size was calculated using the Slovin formula, resulting in a required sample of 166 participants. This sample size was considered adequate for a descriptive usability evaluation and was consistent with prior studies of healthcare information systems.

Instrument Validity and Reliability

The primary instrument used in this study was the Post-Study System Usability Questionnaire (PSSUQ), a standardized and widely used tool for assessing system usability in health information systems.

The PSSUQ demonstrates strong content and construct validity, as IBM developed it to measure user perceptions of system usability comprehensively. The instrument evaluates three core dimensions, including system usefulness, information quality, and interface quality. Previous studies confirmed that PSSUQ items accurately represent usability constructs and are appropriate for evaluating digital health applications, administrative systems, and clinical information platforms.[7] Given its extensive validation in prior research, the PSSUQ was deemed valid for assessing user-perceived usability of the e-credential application in this study.

The PSSUQ has consistently demonstrated high internal consistency reliability across multiple studies, with reported Cronbach's alpha values ranging from 0.91 to 0.96 for the overall scale and its subdomains. These values indicate excellent reliability and stability of the instrument.[7]

In this study, internal consistency reliability was reassessed using Cronbach's alpha. The overall PSSUQ scale demonstrated excellent reliability ($\alpha > 0.90$), indicating that the questionnaire items consistently measured user perceptions of system usability.

Data Collection Procedures

Participants completed the PSSUQ questionnaire and the credentialing process using the e-credential application. The questionnaire captured user perceptions of system ease of use, efficiency, information clarity, and interface quality.

To complement the quantitative data, brief interviews and open-ended questions were conducted with a subset of participants and administrative staff. These were intended to clarify user experiences, identify technical challenges, and gather practical suggestions for system improvement. The interviews were brief, informal, and exploratory. They were not intended as in-depth qualitative interviews. They were used solely to support the interpretation of the questionnaire findings and to inform future system development.

Data Analysis

Quantitative data from the PSSUQ were analyzed descriptively using frequencies, percentages, and mean scores. Reliability analysis was conducted using Cronbach's alpha to assess internal consistency.

Responses from brief interviews and open-ended questions were summarized descriptively and grouped by the issues raised (e.g. access limitations, document revision features). No formal qualitative coding, thematic analysis, or qualitative software was used.

Ethical Considerations

Ethical approval was obtained from the Ethics and Research Committee (No. DP.04.03 / D.XIV.6.5 / 439/2024). All participants provided informed consent before participation. Confidentiality and anonymity were maintained throughout the study.

Results

Participants' Characteristics

A total of 166 nurses and midwives participated in this study and completed the credentialing process using the e-credential application. Participants represented nine peer groups, including critical care, medical–surgical nursing, pediatric nursing, maternity nursing, mental health nursing, operating room, anesthesia, and emergency department services. All participants had recently undergone competency assessments at levels 2, 3, and 4, ensuring respondents had direct, recent experience with the system being evaluated.

System Usability and User Satisfaction

System usability and user satisfaction were evaluated using the PSSUQ. Overall, the e-credential application demonstrated good usability and high user satisfaction, as reflected in low mean scores across all questionnaire domains (Table 1). The overall mean PSSUQ score was 1.87 ± 0.58, indicating a positive user perception of the system; with lower scores indicating better usability.

In the System Usefulness domain (Table 1, items 1–8), the average score was 1.83 ± 0.55, suggesting that users perceived the application as easy to learn, efficient, and supportive in completing credentialing tasks. Respondents reported that they were able to use the system comfortably and become productive in a relatively short time.

The Information Quality domain (Table 1, items 9–15) yielded a mean score of 1.90 ± 0.62. This result indicates that users generally found the system's information to be clear, easy to understand, and well organized. The availability of relevant information within the application supported smooth document submission and reduced confusion during the credentialing process.

Table 1. Post-Study System Usability Questionnaire item scores and user perceived benefits (N = 166).

Item number	Post-Study System Usability Questionnaire*	Mean ± SD
	System Usefulness (items 1–8)	*1.83 ± 0.55*
1	Overall, I am satisfied with how easy it is to use this system	1.82 ± 0.64
2	It was simple to use this system	1.76 ± 0.61
3	I could effectively complete my work using this system	1.88 ± 0.70
4	I was able to complete my work quickly using this system	1.95 ± 0.73
5	I was able to efficiently complete my work using this system	1.89 ± 0.69
6	I felt comfortable using this system	1.84 ± 0.66
7	It was easy to learn to use this system	1.72 ± 0.58
8	I believe I could become productive quickly using this system	1.80 ± 0.62
	Information Quality (items 9–18)	*1.90 ± 0.62*
9	The system gave error messages that clearly told me how to fix problems	2.10 ± 0.81
10	The system provided clear information	1.86 ± 0.67
11	It was easy to find the information I needed	1.90 ± 0.71
12	The information provided was easy to understand	1.78 ± 0.60
13	The information was effective in helping me complete tasks	1.85 ± 0.65
14	The organization of information on the system screens was clear	1.88 ± 0.69
15	The interface of this system was pleasant	1.83 ± 0.63
	Interface Quality (items 1–18)	*1.86 ± 0.59*
16	I liked using the interface of this system	1.79 ± 0.61
17	This system has all the functions and capabilities I expect	1.97 ± 0.74
18	Overall, I am satisfied with this system	1.87 ± 0.58

SD: standard deviation.

*Overall Satisfaction, item numbers: 1–18, Mean ± SD: 1.87 ± 0.58.

For the Interface Quality domain (Table 1, items 16–18), the mean score was 1.86 ± 0.59, reflecting positive perceptions of the system's interface design. Users found the interface pleasant and functional, enabling effective interaction without extensive training or technical assistance. Taken together, the consistently low average scores across all PSSUQ domains indicate that the e-credential application achieved good overall usability, was well accepted by nurses and midwives, and effectively supported the administrative credentialing process.

In addition to usability, respondents perceived several practical benefits from using the e-credential application. Most users reported that the system accelerated the credentialing process and reduced administrative workload, primarily through paperless document submission and centralized data management. The digital system also supported better organization and tracking of credentialing documents, which were viewed as beneficial for the clinical staff and administrators. Users found that the structured digital workflow encouraged timely completion of credentialing requirements and improved compliance with institutional procedures.

Supplementary User Feedback

Brief interviews and open-ended responses were used to clarify user experiences and identify technical improvement needs. User feedback reinforced the quantitative findings, particularly regarding improved efficiency and reduced reliance on physical documents. However, respondents also highlighted several areas for improvement. Common suggestions included expanding system access beyond the hospital network to allow document submission outside working hours and improving the document revision feature to enable replacement of individual files without affecting other uploaded documents. These inputs provide valuable direction for future system development.

Overall, the results indicate that the e-credential application demonstrates good usability, high user satisfaction, and meaningful administrative benefits. While users strongly accepted the system, targeted technical enhancements could further enhance flexibility and the user experience.

Discussion

The results indicate that implementing the e-credential application significantly impacts the credential process's effectiveness and efficiency in the hospital. These outcomes align with previous studies, which confirm that digitalization in the health administration system can improve operational efficiency, minimize human error, and encourage transparency in data management.[8] In addition, this application helps to accelerate the credentialing process for health workers, an important aspect in ensuring the professionalism and competence of nursing staff and midwives.

Regarding nursing staff, this application successfully supports improved competency through structured workflows and clear standards. According to research, using digital technology in training and managing nursing staff can improve their understanding of competency requirements and encourage continuous skill development.[9] Furthermore, the digital-based credentialing process provides more flexible time for nurses to complete administrative tasks to focus on clinical responsibilities, indirectly improving patient care quality.

Hospital management also benefits. An integrated system makes the nursing staff management process more efficient and organized. This is consistent with the findings of a study stating that a digital-based management system supports faster and more accurate data-based decision-making, thereby helping hospital management improve service quality.[10] In addition, the reduction in administrative burden offered by this application allows management to allocate human resources and time to other priority areas that require special attention.

Patients and families also experience the impact of implementing this application. The professionalism of health workers, which is standardized through digital-based credentials, directly increases patient trust in health services. According to one study, the quality of health services is greatly influenced by the competence of health workers, which can be improved through a transparent and structured credential mechanism.[11] Thus, the e-credential application supports health workers and improves the overall patient experience.

Limitations

The challenges found in this study, such as limited access to the application outside the hospital network, indicate that further development is needed to meet user needs. Adopting digital technology in the health sector must be accompanied by flexibility features that allow access from multiple locations to support remote work, especially in pandemic situations or when health workers are not on duty at health facilities.[12] Also, although the PSSUQ is a validated and reliable instrument, the study relied on self-reported usability perceptions. Additionally, purposive sampling and brief exploratory interviews may limit generalizability and depth of contextual understanding.

Conclusion

This study results demonstrate that implementing an e-credential application for nurses and midwives is associated with high system usability and user satisfaction, as evidenced by favorable PSSUQ scores. Users perceived the system as easy to learn, efficient, and

supportive of the credentialing process, particularly in reducing administrative workload and simplifying document management.

The digital credentialing system facilitated a more structured, paperless credentialing process, improving efficiency and better organizing credential-related information. From the perspective of nursing staff and administrators, the application supported the timely completion of credentialing requirements and enhanced procedural clarity.

Despite these positive findings, several areas for improvement were identified, including expanding system access beyond the hospital network and enhancing document revision functionality. Addressing these technical aspects further improves system flexibility and user experience.

Overall, the e-credential application shows strong potential as a digital innovation for credential management in hospital settings. Future studies should include multicenter evaluations and objective performance indicators to further assess its impact on operational efficiency and healthcare service quality.

Funding

This study received financial and institutional support from STIKes Fatmawati and internal institutional resources from the hospital. The funding body had no role in the study design, data collection, analysis, interpretation of data, or writing of the manuscript.

Conflicts of Interest

The authors declare no conflict of interest.

Contributions

Amelia Ganefianty: conceptualization, methodology, supervision, project administration, writing (original draft, review & editing); Deny Prasetyanto: software development, system design and programming, validation, data curation, technical documentation, writing (review & editing); Neneng Kurniati: investigation, data collection, formal analysis, writing (review & editing); Titin Mulyati: methodology, validation, investigation, writing (review & editing); Sri Yulia Rahayu: Data curation, investigation, resources, writing – review and editing; Ranti Haryati: Data collection, project administration, writing – review & editing; Romanian Romanian: System testing technical validation, software support, visualization; Hafsa Hafsa: Formal analysis, data interpretation, writing – review & editing; Meitha Roosmeilany: Resources, institutional coordination, supervision; Oded Sumarna: Supervision, funding acquisition, policy alignment and institutional endorsement. All authors approved the final manuscript and agreed to be accountable for all aspects of the work.

Data Availability Statement (DAS), Data Sharing, Reproducibility, and Data Repositories

The datasets generated and/or analysed during the current study are not publicly available due to institutional confidentiality and data protection regulations of the Vertical Hospital in Indonesia but are available from the corresponding author on reasonable request and with permission from the hospital authority.

The development process of the e-credential application, including system architecture, workflow design, and implementation framework, is described in sufficient detail within the manuscript to allow replication in similar healthcare settings. However, adaptation may be required to align with local regulations, credentialing policies, and institutional IT infrastructure.

De-identified aggregated data supporting the findings of this study may be shared upon reasonable request to the corresponding author, subject to approval by the institutional review board and hospital management. The e-credential application source code is proprietary to the institution and is not publicly available.

Application of AI-Generated Text or Related Technology

The authors declare that artificial intelligence tools were used solely for language refinement and grammar checking during manuscript preparation. All conceptual development, analysis, interpretation, and final approval of the manuscript were performed by the authors. The authors take full responsibility for the content of this publication.

Acknowledgments

The authors would like to express their sincere gratitude to the Hospital Information System (SIRS) team of RSUP Dr. Hasan Sadikin Bandung for their technical assistance and support in integrating the e-credential system within the hospital information infrastructure.

The authors also acknowledge the contribution of hospital management and nursing staff who participated in the development and implementation of the system.

References

1. Haleem A, Javaid M, Pratap Singh R, Suman R. Medical 4.0 technologies for healthcare: features, capabilities, and applications. Internet Things Cyber-Physical Syst. 2022;2(April):12–30. https://doi.org/10.1016/j.iotcps.2022.04.001
2. Sugito, Dwiantoro L, Anggorowati, Ardani MH, Sulisno M. Implementation of nursing credentials and recredentials by the credentials subcommittee at X Distric Hospital. J Ber Ilmu Keperawatan. 2023;16(1):53–67. https://doi.org/10.23917/bik.v16i1.1375
3. Sadoughi F, Nasiri S, Ahmadi H. The impact of health information exchange on healthcare quality and cost-effectiveness: a systematic literature review. Comput Methods Programs

Biomed. 2018;161:209–32. https://doi.org/10.1016/j.cmpb.2018.04.023
4. Auerbach M, Stone KP, Patterson MD. The role of simulation in improving patient safety. 2016; p. 55–65. https://doi.org/10.1007/978-3-319-24187-6_5
5. Hanif CA, Amirulloh M, Muchtar HN. Reliability and security in the implementation of digital health service application with the application of 'Reliability Certification or Electronic Certification' based on Indonesian Law. Padjadjaran J Ilmu Huk. 2021;8(3):417–38. https://doi.org/10.22304/pjih.v8n3.a6
6. Saif S, Das P, Biswas S, Khan S, Haq MA, Kovtun V. A secure data transmission framework for IoT enabled healthcare. Heliyon. 2024;10(16):e36269. https://doi.org/10.1016/j.heliyon.2024.e36269
7. Lewis JR. Psychometric evaluation of the PSSUQ using data from five years of usability studies. Int J Hum Comput Interact. 2015;14:463–88. https://doi.org/10.1207/S15327590IJHC143&4_11
8. Senbekov M, Saliev T, Bukeyeva Z, Almabayeva A, Zhanaliyeva M, Aitenova N, et al. The recent progress and applications of digital technologies in healthcare: a review. Int J Telemed Appl. 2020:1–18. https://doi.org/10.1155/2020/8830200
9. Chakroun B, Keevy J. Digital credentialing: implications for the recognition of learning across borders [Internet]. UNESCO; 2018 [cited 2025 Jun 9]. Available from: https://hdl.voced.edu.au/10707/494278
10. Schiavone F, Pietronudo MC, Sabetta A, Ferretti M. Total quality service in digital era. TQM J. 2023;35(5):1170–93. https://doi.org/10.1108/TQM-12-2021-0377
11. Needleman J, Dittus RS, Pittman P, Spetz J, Newhouse R. Nurse credentialing research frameworks and perspectives for assessing a research agenda. NAM Perspect. 2014;4(8). https://doi.org/10.31478/201408d
12. Anawade PA, Sharma D, Gahane S. A comprehensive review on exploring the impact of telemedicine on healthcare accessibility. Cureus. 2024;16(3). https://doi.org/10.7759/cureus.55996