

# **The Application of Technology to Improve Nursing Care in Clinical Environments: Benefits & Limitations for Nursing Practice**

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# The Application of Technology to Improve Nursing Care in Clinical Environments: Benefits & Limitations for Nursing Practice

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## Abstract

**Background:** This initiative investigated whether enhancing nurse education on clinical technology elevates their understanding and underscores the necessity of addressing implementation challenges. A mixed-methods strategy was employed, featuring a PowerPoint presentation aimed at IT personnel, nurses, and management. Knowledge was evaluated through pre-and post-tests, while qualitative insights were gathered to reflect nursing viewpoints. Out of twenty invited nurses, sixteen chose to participate. The results from the post-test indicated a heightened awareness of the difficulties associated with technology implementation, with 50% recognizing additional barriers than previously identified. Nurses with over a decade of experience and those aged 36 and above reported lower levels of comfort with technology, indicating a demand for specialized training. In spite of the challenges faced, 31.25% acknowledged more advantages following the presentation, while the majority were already aware that improved patient outcomes were a significant benefit. The results highlight that while nurses appreciate the importance of technology in patient care, effective integration necessitates tackling training deficiencies and institutional hurdles. Healthcare facilities must emphasize continuous education and assistance to foster technological adoption and ultimately enhance clinical efficiency and patient care outcomes.

**Objective:** This project aims to determine if educating nurses on the use of technology in the clinical environment improves knowledge. By clarifying identified barriers, the initiative additionally targeted to highlight the importance of removing obstacles. This will ensure staff receive sufficient training. In addition, nurses will have access to innovative technical improvements, ultimately increasing patient care and optimize outcomes.

**Methods:** The project followed a mixed method of receiving both quantitative and qualitative response data, focusing on educating IT personnel, surgical nurses, and managers with a PowerPoint presentation regarding the importance of utilizing technology in the clinical setting. Pre-tests were given before the educational session, and post-tests were given after the educational session. Both pre and post-tests included a total of twenty questions, with the first fourteen pre-test questions and the last six post-test questions being the same for each questionnaire. The questions were a mixture of select all that apply and multiple choice question formats. Qualitative data was collected based on nursing perspectives and expected benefits, which were, in turn, thematically analyzed to base conclusions on quantified responses. Quantitative data was also collected through demographic-based questions, frequency-based questions, and categorical-based questions.

**Results:** Twenty nurses were invited to participate, and sixteen participated in the educational session, yielding 80% of the staff that participated. Of the four who were unable to attend, two nurses had obligations with patients tending to their care, one nurse left early for a sporting event for their kid, and one nurse was out on sick leave on the day the presentation was given. The average pre-test result showed increased workflow efficiency being the most commonly thought benefit of technology implementation in the healthcare setting. Of the number of respondents, 50% saw more significant challenges to implementing technology in the clinical setting after the presentation was given than before. Only 12% of the respondents thought there were less challenges to technology implementation after the presentation was given. This suggests that the majority of healthcare employees learned that there are more challenges to implementing technology in the clinical setting than their original thoughts.

Survey respondents, composed of 56.25%, felt that they were very comfortable with their technology proficiency. Participants who answered that they were somewhat or very uncomfortable with their technology proficiency were those with experience of 10+ years and were 36 years or older. Those with five or less years of experience all answered that they felt somewhat or very comfortable with technology proficiency. This suggests that further training is needed for those who are well into their careers who might not have had to implement technology in various ways when originally learning healthcare skills. After the presentation, 31.25% of participants believed there to be more principal advantages to integrating healthcare than before the presentation. The presentation had virtually no effect on the feeling that improved patient outcomes were a principal advantage of technology. This was a known belief before this, which should spur those training healthcare employees and creating new technology-based resources, as there is already an understanding that it plays a vital role in patient care. The challenge lies in the proper training of nurses, not the belief that technology needs to be utilized in the clinical setting.

**Conclusions:** The project demonstrated that an educational presentation culminated in the acknowledgment of the obstacles associated with the implementation of technology. Consequently, hospital personnel and those in administrative roles must comprehend the necessity of dismantling barriers. Addressing these barriers will ensure staff receive adequate training and are provided with the most current technological advancements. As a result, this leads to an overall improvement in patient care.

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## Original Manuscript

The Application of Technology to Improve Nursing Care in Clinical Environments:  
Benefits & Limitations for Nursing Practice

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*Abstract*

This initiative investigated whether enhancing nurse education on clinical technology

elevates their understanding and underscores the necessity of addressing implementation challenges. A mixed-methods strategy was employed, featuring a PowerPoint presentation aimed at IT personnel, nurses, and management. Knowledge was evaluated through pre-and post-tests, while qualitative insights were gathered to reflect nursing viewpoints. Out of twenty invited nurses, sixteen chose to participate. The results from the post-test indicated a heightened awareness of the difficulties associated with technology implementation, with 50% recognizing additional barriers than previously identified. Nurses with over a decade of experience and those aged 36 and above reported lower levels of comfort with technology, indicating a demand for specialized training. In spite of the challenges faced, 31.25% acknowledged more advantages following the presentation, while the majority were already aware that improved patient outcomes were a significant benefit. The results highlight that while nurses appreciate the importance of technology in patient care, effective integration necessitates tackling training deficiencies and institutional hurdles. Healthcare facilities must emphasize continuous education and assistance to foster technological adoption and ultimately enhance clinical efficiency and patient care outcomes.

**Keywords:** technology, benefits and limitation, nurses perspective

**Disclaimer:** larger pool of study

*Introduction:* This project aims to determine if educating nurses on the use of technology in the clinical environment improves knowledge. By clarifying identified barriers, the initiative additionally targeted to highlight the importance of removing obstacles. This will ensure staff receive sufficient training. In addition, nurses will have access to innovative technical improvements, ultimately increasing patient care and optimize outcomes.

*Method:* The project followed a mixed method of receiving both quantitative and qualitative response data, focusing on educating IT personnel, surgical nurses, and managers with a PowerPoint presentation regarding the importance of utilizing technology in the clinical setting. Pre-tests were

given before the educational session, and post-tests were given after the educational session. Both pre and post-tests included a total of twenty questions, with the first fourteen pre-test questions and the last six post-test questions being the same for each questionnaire. The questions were a mixture of select all that apply and multiple choice question formats. Qualitative data was collected based on nursing perspectives and expected benefits, which were, in turn, thematically analyzed to base conclusions on quantified responses. Quantitative data was also collected through demographic-based questions, frequency-based questions, and categorical-based questions.

*Results:* Twenty nurses were invited to participate, and sixteen participated in the educational session, yielding 80% of the staff that participated. Of the four who were unable to attend, two nurses had obligations with patients tending to their care, one nurse left early for a sporting event for their kid, and one nurse was out on sick leave on the day the presentation was given. The average pre-test result showed increased workflow efficiency being the most commonly thought benefit of technology implementation in the healthcare setting. Of the number of respondents, 50% saw more significant challenges to implementing technology in the clinical setting after the presentation was given than before. Only 12% of the respondents thought there were less challenges to technology implementation after the presentation was given. This suggests that the majority of healthcare employees learned that there are more challenges to implementing technology in the clinical setting than their original thoughts. Survey respondents, composed of 56.25%, felt that they were very comfortable with their technology proficiency. Participants who answered that they were somewhat or very uncomfortable with their technology proficiency were those with experience of 10+ years and were 36 years or older. Those with five or less years of experience all answered that they felt somewhat or very comfortable with technology proficiency. This suggests that further training is needed for those who are well into their careers who might not have had to implement technology in various ways when originally learning healthcare skills. After the presentation, 31.25% of participants believed there to be more principal advantages to integrating healthcare than before the

presentation. The presentation had virtually no effect on the feeling that improved patient outcomes were a principal advantage of technology. This was a known belief before this, which should spur those training healthcare employees and creating new technology-based resources, as there is already an understanding that it plays a vital role in patient care. The challenge lies in the proper training of nurses, not the belief that technology needs to be utilized in the clinical setting.

*Discussion:* The integration of technology within clinical settings has profoundly transformed the provision of healthcare, consequently improving operational efficacy, patient outcomes, and the workflows of healthcare practitioners. This investigation explores the advantages and drawbacks associated with the incorporation of technology in clinical practice, with particular emphasis on electronic health records (EHRs), TeleHealth, robotics, and wearable health devices. Benefits include improved patient safety, heightened efficiency while alleviating the workload of nursing staff, and enhanced educational opportunities. However, challenges such as security vulnerabilities, increased expenditures, and potential resistance to change necessitate thorough examination. By performing a detailed examination of current academic work and its practical implications, this investigation seeks to present recommendations that are founded on evidence aimed at maximizing technological usage in clinical environments while also tackling its fundamental weaknesses. The project focused on educating IT personnel, surgical nurses, and managers with a PowerPoint presentation regarding the importance of utilizing technology in the clinical setting. Twenty nurses were invited to participate, and sixteen participated in the educational session, yielding 80% of the staff that participated. Of the four who were unable to attend, two nurses had obligations with patients tending to their care, one nurse left early for a sporting event for their kid, and one nurse was out on sick leave on the day the presentation was given. The project followed a mixed method of receiving both quantitative and qualitative response data. Pre-tests were given before the educational session, and post-tests were given after the educational session. Both pre and post-tests included a total of twenty questions, with the first fourteen pre-test questions and the last six post-test questions being the same for each

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must comprehend the importance of disassembling barriers. Addressing these barriers will ensure staff receive adequate training and are provided with the most current technological advancements. As a result, this leads to an overall improvement in patient care.

*Limitations:* A significant limitation of this research was its execution within a singular nursing unit at a solitary hospital, resulting in a restricted sample size. The intervention was exclusively administered to perioperative nurses, IT personnel, and managers associated with the surgical services department on a single occasion. The abbreviated duration of the intervention, coupled with the limited sample size produced negligible outcomes. The study's efficacy could have been enhanced had it been conducted across multiple hospital units, thereby providing various opportunities for both staff and administration to engage in the educational session, which would have expanded the sample size and the assortment of the study's outcomes. Furthermore, an additional limitation of this investigation was that the student researcher independently developed the pre-tests and post-tests without seeking expert consultation to assist in formulating the test questions, potentially compromising the quality of the assessment items. The student researcher also evaluated the questionnaire based on numerous open-ended responses with no quantitative results.

*Conclusion:* The project demonstrated that an educational presentation culminated in the acknowledgment of the obstacles associated with the implementation of technology. Consequently, hospital personnel and those in administrative roles must comprehend the necessity of dismantling barriers. Addressing these barriers will ensure staff receive adequate training and are provided with the most current technological advancements. As a result, this leads to an overall improvement in patient care.

## Appendix A

### Pre- Test

#### **Pre-Presentation Questions**

##### Section 1: Demographics

1. What is your age category?
  - ☐ 18-25
  - ☐ 26-35
  - ☐ 36-45
  - ☐ 46-55
  - ☐ 56+
2. What is the highest level of academic achievement in nursing you have attained?
  - ☐ Diploma in Nursing
  - ☐ Associate Degree in Nursing (ADN)
  - ☐ Bachelor of Science in Nursing (BSN)
  - ☐ Master of Science in Nursing (MSN)
  - ☐ Doctorate (DNP/PhD)
3. How many years of professional experience do you possess in the field of nursing?
  - ☐ 0-2 years
  - ☐ 3-5 years
  - ☐ 6-10 years
  - ☐ 11-20 years
  - ☐ 21+ years

4. In which type of healthcare environment do you primarily practice?

- ☐ Hospital
- ☐ Clinic
- ☐ IT
- ☐ Home Health
- ☐ Other (please specify): \_\_\_\_\_

## Section 2: Use of Technology in Nursing Care

5. How frequently do you implement technology in your daily nursing practice?

- ☐ Never
- ☐ Rarely
- ☐ Occasionally
- ☐ Frequently
- ☐ Always

6. Which categories of healthcare technology do you most commonly utilize? (Select all that apply) Electronic Health Records (EHR)

- ☐ Telemedicine Platforms
- ☐ Mobile Health Applications
- ☐ Automated Medication Dispensing Systems
- ☐ Patient Monitoring Devices
- ☐ Artificial Intelligence-Driven Decision Support Systems
- ☐ Other (Please Specify): \_\_\_\_\_

7. How proficient do you feel in utilizing technology in nursing care?

- ☐ Very Uncomfortable
- ☐ Somewhat Uncomfortable
- ☐ Neutral

- ☐ Somewhat Comfortable
  - ☐ Very Comfortable
8. In what manner has technology influenced your efficiency in delivering patient care?
- ☐ Decreased Efficiency
  - ☐ No Impact
  - ☐ Slightly Improved Efficiency
  - ☐ Greatly Improved Efficiency

### Section 3: Benefits and Challenges of Technology in Nursing

9. What are the principal advantages of technology integration in nursing care? (Select all that apply)
- ☐ Improved Patient Outcomes
  - ☐ Increased Workflow Efficiency
  - ☐ Enhanced Communication Among Healthcare Providers
  - ☐ Reduced Documentation Errors
  - ☐ Better Patient Engagement and Education
  - ☐ Other (Please Specify): \_\_\_\_\_
10. What are the most significant challenges you encounter when employing technology in nursing care? (Select all that apply)
- ☐ Lack of Proper Training
  - ☐ Technical Difficulties or System Failures
  - ☐ Increased Workload Due to Documentation Requirements
  - ☐ Patient Resistance to Technology
  - ☐ Privacy and Security Concerns
  - ☐ Other (Please Specify): \_\_\_\_\_
11. Have you obtained sufficient training to proficiently utilize healthcare technology in your professional capacity?

- ☐ Yes
- ☐ No
- ☐ Somewhat

#### Section 4: Future Improvements in Healthcare Technology

12. What supplementary training or support would facilitate your better integration of technology into patient care?

- ☐ Hands-On Training Sessions
- ☐ Online Tutorials and Resources
- ☐ Peer Mentorship Programs
- ☐ Dedicated IT Support Teams
- ☐ Other (Please Specify): \_\_\_\_\_

13. What enhancements would you propose for existing healthcare technologies?

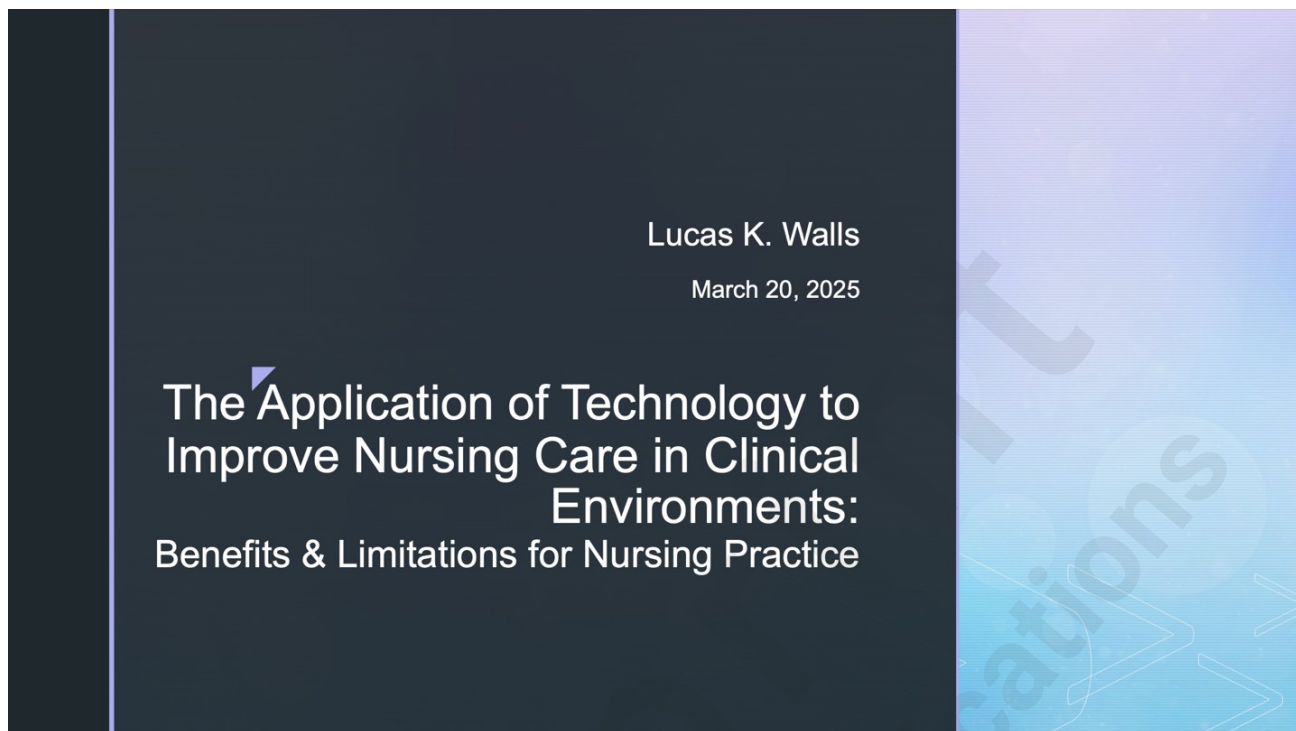
- ☐ User-Friendly Interfaces
- ☐ Faster System Performance
- ☐ Better Interoperability Between Different Systems
- ☐ Enhanced Patient Privacy Measures
- ☐ Other (Please Specify): \_\_\_\_\_

14. In your assessment, what is the prospective role of technology in the realm of nursing care?

- ☐ Minimal Impact
- ☐ Moderate Impact
- ☐ Major Transformation of Nursing Practice

## Appendix B

## PowerPoint Presentation



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## Types of Technology in Clinical Environments

- Electronic Health Records (EHRs)
- TeleHealth and Remote Monitoring
- Automated Medication Dispensing Systems (OmniCell)
- Wearable Health Devices (AED)
- Robotics in Patient Care

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## Electronic Health Records (EHRs)

A recent study suggests the importance of competencies for public health nursing in the areas of data analytics, the use of application and clinician-facing technologies, such as electronic health records, clinical decision mobile applications, and screening and referral tools (Leaver et al., 2022).

- Benefits: Improved documentation, accessibility, reduced errors
- Limitations: Privacy concerns, learning curve, potential technical failures

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## TeleHealth & Remote Monitoring

“In three months, almost 9000 (67%) of patient admissions and discharges were conducted by the tele-nurse, saving the bedside nurse an average of 45 min for each admission and discharge” (Schwartz et al., 2024).

- Benefits: Expanded access to care, convenience for patients and nurses, real-time monitoring, time-saving patient care
- Limitations: Digital divide, potential misdiagnoses, reliance on stable internet

6

## Automated Medication Dispensing Systems

Wellstar West Georgia – OmniCell

- Benefits: Reduced medication errors, increased efficiency, improved inventory management
- Limitations: System failures, initial high costs, reliance on technology over human judgment

7

## Wearable Health Devices

Research Suggests that Patients View WHDs in a Positive Light Since it Requires Them to Become More Active/Aware in Their Healthcare Journey

- Benefits: Continuous health monitoring, early detection of conditions, patient empowerment
- Limitations: Accuracy concerns, data privacy issues, dependence on patient compliance

8

## Robotics in Patient Care

Especially Seen in the Operating Room

- Benefits: Assistance with repetitive tasks, reduction in physical strain for nurses, increased patient independence
- Limitations: High costs, possible reduction in human interaction, maintenance challenges

## Overall Benefits of Technology in Nursing

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### Improved Patient Safety and Engagement

- Technology facilitates better monitoring and management of patient health, leading to safer outcomes
- Electronic Health Records (EHR) enhance access to patient information, leading to informed decision-making
- In a study of an older, technology-hesitant population, once proper education was completed, the use of modern technology in healthcare did not only lead to adoption but was viewed favorably.

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## Increased Efficiency & Reduced Workload for Nurses

- Automation of routine tasks allows nurses to focus more on patient care.
- Streamlined communication between healthcare professionals improves collaboration. As seen by the nurses in this study, the ICU devices along with constant communication with experienced co-workers have made the quality of care better and have improved the way nursing care is carried out (Olorunfemi et al., 2020).

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## Enhanced Training & Education

- Access to online resources and training programs helps nurses stay updated with the latest practices.
- Viewpoints on robotic technology educational sessions have resulted in positive opinions.
- Virtual reality modules were implemented alongside standard video lecture techniques.
- Simulation technologies provide hands-on experience in a controlled environment.

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## Cost Effectiveness

- Reduces operational costs by minimizing paperwork and improving resource allocation of money and people.
- Streamlines communication between healthcare providers, resulting in fewer chances of misdiagnosing, leading to more costly tests.

## Limitations & Challenges of Technology in Nursing

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## Security Risks, Costs, & Concerns

- Technical Challenges
- Training Requirements
- Resistance to Change
- Privacy Concerns

16

## Cost of Future Advancements

- Canadian example of AED devices in communities
- Smart hospitals and Internet of Medical Things (IoMT)
- Insurance coverage and out-of-pocket costs to patients when utilizing cutting edge technology

## Conclusion

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## Key Takeaways

- The integration of technology in nursing practice presents numerous benefits, including improved patient outcomes and increased efficiency.
- However, it is essential to address the limitations and challenges to optimize technology adoption in clinical environments.
- There is always a need for balance between technology and the human touch in nursing.

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## Recommendations

- Ongoing training and support for nursing staff.
- Development of user-friendly technology solutions.
- Regular assessments of technology impact on nursing practice to ensure continuous improvement.

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## Appendix C

## Post- Test

**Post-Presentation Questions**

**Please complete the next portion AFTER the presentation when instructed.**

## Section 5: Benefits and Challenges of Technology in Nursing

15. What are the principal advantages of technology integration in nursing care? (Select all that apply)

- ☐ Improved Patient Outcomes
- ☐ Increased Workflow Efficiency
- ☐ Enhanced Communication Among Healthcare Providers
- ☐ Reduced Documentation Errors
- ☐ Better Patient Engagement and Education
- ☐ Other (Please Specify): \_\_\_\_\_

16. What are the most significant challenges you encounter when employing technology in nursing care? (Select all that apply)

- ☐ Lack of Proper Training
- ☐ Technical Difficulties or System Failures
- ☐ Increased Workload Due to Documentation Requirements
- ☐ Patient Resistance to Technology
- ☐ Privacy and Security Concerns
- ☐ Other (Please Specify): \_\_\_\_\_

17. Have you obtained sufficient training to proficiently utilize healthcare technology in your professional capacity?

- ☐ Yes

- ☐ No
- ☐ Somewhat

#### Section 6: Future Improvements in Healthcare Technology

18. What supplementary training or support would facilitate your better integration of technology into patient care?

- ☐ Hands-On Training Sessions
- ☐ Online Tutorials and Resources
- ☐ Peer Mentorship Programs
- ☐ Dedicated IT Support Teams
- ☐ Other (Please Specify): \_\_\_\_\_

19. What enhancements would you propose for existing healthcare technologies?

- ☐ User-Friendly Interfaces
- ☐ Faster System Performance
- ☐ Better Interoperability Between Different Systems
- ☐ Enhanced Patient Privacy Measures
- ☐ Other (Please Specify): \_\_\_\_\_

20. In your assessment, what is the prospective role of technology in the realm of nursing care?

- ☐ Minimal Impact
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## Supplementary Files