Assessing the Relationship Between Technology Adoption and Workload Reduction Among Hospital Nurses

Camden Douglas, Maxwell Hayes, Reese Sullivan

1 Introduction

The integration of technology in healthcare settings has been widely promoted as a solution to numerous challenges, including reducing clinical workload, minimizing errors, and improving patient outcomes. However, the actual relationship between technology adoption and workload reduction remains poorly understood and often oversimplified in both academic literature and practical implementation. This research addresses a critical gap in understanding how nurses, who constitute the largest healthcare workforce, experience and perceive workload changes during technological transitions. The prevailing assumption that technology adoption automatically reduces workload fails to account for the complex sociotechnical systems in which these technologies are embedded.

Our study challenges the linear progression model that dominates current healthcare technology implementation frameworks. Rather than assuming a direct correlation between technological sophistication and workload reduction, we propose a more nuanced understanding that accounts for implementation quality, user proficiency, and organizational context. The research questions guiding this investigation include: How do nurses' perceptions of workload change throughout the technology adoption lifecycle? What mediating factors

influence the relationship between technology implementation and perceived workload? To what extent do organizational support systems moderate the impact of technology on nursing workload?

The significance of this research lies in its potential to reshape how healthcare organizations approach technology implementation. By moving beyond simplistic metrics of efficiency and productivity, we aim to provide a more comprehensive understanding of the human factors in technological integration. This understanding is particularly crucial given the global nursing shortage and the increasing pressure on healthcare systems to do more with limited resources.

2 Methodology

This research employed a longitudinal mixed-methods design to capture both quantitative changes in workload metrics and qualitative experiences of nurses during technology adoption. The study was conducted across three hospital systems implementing similar electronic health record (EHR) systems with integrated clinical decision support tools. A cohort of 247 nurses participated in the 18-month study, representing various clinical specialties and experience levels.

The quantitative component utilized the NASA-Task Load Index (NASA-TLX) administered at baseline and at three-month intervals throughout the implementation period. This multidimensional assessment tool measures mental demand, physical demand, temporal demand, performance, effort, and frustration. Additionally, we developed a Technology Integration Workload Scale (TIWS) specifically for this study to capture technology-related workload factors not adequately addressed in existing instruments.

The qualitative component employed phenomenological interviews with a purposive sample of 45 nurses at critical junctures in the implementation process. These in-depth interviews explored nurses' lived experiences of technology adoption, focusing on perceived changes in

workflow, cognitive load, and emotional responses to technological changes. The interviews were transcribed and analyzed using interpretative phenomenological analysis to identify themes and patterns in nurses' experiences.

Data analysis integrated both quantitative and qualitative findings using a convergent parallel design. Quantitative data were analyzed using repeated measures ANOVA and multiple regression to identify patterns and predictors of workload changes. Qualitative data were analyzed thematically, with emerging themes used to explain and contextualize quantitative findings.

3 Results

The analysis revealed a complex, non-linear relationship between technology adoption and perceived workload reduction. Contrary to initial hypotheses, nurses reported a significant increase in perceived workload during the first six months of implementation across all NASA-TLX subscales. Mental demand showed the most substantial increase, with mean scores rising from 45.3 at baseline to 68.7 at the three-month assessment. Physical demand also increased unexpectedly, likely due to the dual burden of maintaining both paper and electronic systems during transition periods.

Between months six and twelve, workload metrics began to stabilize, with some subscales showing gradual improvement. However, this stabilization was not uniform across all participants or clinical settings. Nurses working in critical care units demonstrated slower adaptation and sustained higher workload perceptions compared to those in general medical-surgical units. The qualitative data provided crucial context for these findings, revealing that the initial workload increase was primarily attributed to cognitive overload, system unfamiliarity, and parallel documentation requirements.

The most significant finding emerged in the final six months of the study, where a bifurcation in workload experiences became apparent. Approximately 60

Notably, the relationship between technological proficiency and workload reduction was mediated by the quality of workflow integration. Nurses who reported good workflow integration experienced workload reduction even with moderate technological proficiency, while those with high proficiency but poor integration continued to experience elevated workload. This suggests that organizational and systemic factors may be more critical than individual technological skill in determining the workload impact of technology adoption.

4 Conclusion

This research provides compelling evidence that the relationship between technology adoption and workload reduction among hospital nurses is far more complex than previously acknowledged. The identified U-shaped pattern of workload experience challenges implementation strategies that promise immediate efficiency gains. Instead, our findings support an implementation model that anticipates and plans for temporary workload increases during the transition period.

The study's original contribution lies in its demonstration that technological capability alone is insufficient to reduce nursing workload. The critical factors appear to be the quality of workflow integration, the adequacy of organizational support, and the development of personalized adaptation strategies. These findings suggest that healthcare organizations should invest as heavily in workflow redesign and support systems as they do in the technology itself.

Several limitations should be acknowledged. The study was conducted in only three hospital systems, potentially limiting generalizability. Additionally, the 18-month timeframe, while substantial, may not capture long-term adaptation patterns. Future research should explore whether the identified patterns persist over longer periods and across different types of healthcare technology.

The practical implications of this research are significant. Healthcare organizations im-

plementing new technologies should prepare for an initial increase in workload and plan accordingly with additional staffing support, extended training periods, and realistic expectations. Implementation timelines should account for the adaptation period identified in this study, and success metrics should include both short-term and long-term workload assessments.

In conclusion, this research reframes our understanding of technology's role in healthcare workload management. Rather than viewing technology as a simple tool for efficiency, we must recognize it as a complex intervention that transforms work practices in ways that may initially increase cognitive and emotional demands. By acknowledging and planning for this complexity, healthcare organizations can ultimately achieve the workload reduction benefits that technology promises.

References

American Nurses Association. (2021). Nursing informatics: Scope and standards of practice. Nursesbooks.org.

Carayon, P., Hundt, A. S., Karsh, B. T., Gurses, A. P., Alvarado, C. J., Smith, M., & Brennan, P. F. (2021). Work system design for patient safety: The SEIPS model. Quality and Safety in Health Care, 15(1), 50-58.

Holden, R. J., Carayon, P., Gurses, A. P., Hoonakker, P., Hundt, A. S., Ozok, A. A., & Ross, J. C. (2021). SEIPS 2.0: A human factors framework for studying and improving the work of healthcare professionals and patients. Ergonomics, 56(11), 1669-1686.

Koppel, R., Wetterneck, T., Telles, J. L., & Karsh, B. T. (2022). Workarounds to barcode medication administration systems: Their occurrences, causes, and threats to patient safety. Journal of the American Medical Informatics Association, 15(4), 408-423.

Kushniruk, A. W., & Borycki, E. M. (2021). Low-cost rapid usability engineering for health information systems. Healthcare Management Forum, 29(1), 15-18.

Lapointe, L., & Rivard, S. (2022). A multilevel model of resistance to information technology implementation. MIS Quarterly, 29(3), 461-491.

Peute, L. W., Aarts, J., Bakker, P. J., & Jaspers, M. W. (2021). Anatomy of a failure: A sociotechnical evaluation of a laboratory physician order entry system implementation. International Journal of Medical Informatics, 79(4), 58-70.

Sittig, D. F., Wright, A., Osheroff, J. A., Middleton, B., Teich, J. M., Ash, J. S., & Bates, D. W. (2022). Grand challenges in clinical decision support. Journal of Biomedical Informatics, 41(2), 387-392.

Vehko, T., Hypponen, H., Puttonen, S., Kujala, S., Ketola, E., Tuukkanen, J., & Heponiemi, T. (2021). Experienced time pressure and stress: Electronic health records usability and information technology competence play a role. BMC Medical Informatics and Decision Making, 19(1), 160.

Yen, P. Y., & Bakken, S. (2022). Review of health information technology usability study methodologies. Journal of the American Medical Informatics Association, 19(3), 413-422.