The Relationship Between Nurses' Digital Health Literacy and Emotional Exhaustion in Tertiary Care Hospitals

The Relationship Between Nurses' Digital Health Literacy and Emotional Exhaustion in Tertiary Care Hospitals

Aisha Noor

University of Warwick

Abstract

Purpose: The purpose of this article was to analyze the relationship between nurses' digital health literacy and emotional exhaustion in tertiary care hospitals.

Methodology: This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low cost advantage as compared to a field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

Findings: Based on current research, a significant inverse relationship exists between nurses' digital health literacy and emotional exhaustion in tertiary care hospitals. Higher proficiency in using digital health tools and navigating electronic health information is consistently associated with lower levels of emotional exhaustion, a core dimension of burnout. This suggests that improving digital health literacy may serve as a protective factor, enhancing work efficiency and reducing the technological stress that contributes to burnout among nurses in high-complexity care settings.

Unique Contribution to Theory, Practice and Policy: Job demands-resources (JD-R) theory, transactional model of stress and coping conservation of resources (COR) theory may be used to anchor future studies on the relationship between nurses' digital health literacy and emotional exhaustion in tertiary care hospitals. For hospital administrators and nurse leaders, this study provides actionable, evidence-based strategies to mitigate burnout by targeting a modifiable skill set. At the policy level, this research provides a compelling evidence base to advocate for systemic changes that protect the nursing workforce in an increasingly digital healthcare ecosystem.

Keywords: *Digital Health Literacy, Emotional Exhaustion, Tertiary Care Hospitals*

INTRODUCTION

Emotional exhaustion, a core dimension of burnout measured by the Maslach Burnout Inventory (MBI), is characterized by feelings of being emotionally overextended, drained, and depleted of one's emotional resources due to chronic work stressors. In developed economies with advanced but high-pressure healthcare systems, this manifests as a profound weariness from cumulative exposure to high patient acuity, administrative burdens, and relentless demands. For example, a large-scale pre-pandemic study in the United States found that over 35% of registered nurses scored high on the MBI emotional exhaustion subscale, with critical care and emergency nurses consistently reporting the highest rates. In the United Kingdom, a 2019 National Health Service (NHS) staff survey revealed that 40.3% of nursing staff reported feeling unwell due to work-related stress in the preceding year, a key proxy for emotional exhaustion, with workload and lack of resources cited as primary causes (Shah, 2021). The COVID-19 pandemic dramatically exacerbated these trends, with studies from Japan and the USA post-2020 reporting rates of high emotional exhaustion climbing to between 50-70% among frontline hospital nurses, indicating a severe and sustained occupational health crisis.

In developing economies, such as those in Southeast Asia or Latin America, emotional exhaustion among nurses is compounded by systemic resource constraints, leading to a different but equally severe profile. The chronic strain stems not only from high workloads but also from fundamental infrastructural deficiencies, including severe nurse-patient ratios, sporadic shortages of basic supplies, and less sophisticated but often poorly integrated digital systems. For instance, a multi-center study in the Philippines reported that 61.2% of nurses experienced high emotional exhaustion, significantly linked to inadequate staffing and low remuneration. Similarly, research from Brazil identified that 58% of intensive care nurses exhibited high emotional exhaustion, heavily associated with a lack of organizational support and excessive psychological demands (Molina-Praena, 2018). The scarcity of mental health resources and stigma around psychological distress in many of these cultures often means this exhaustion is underreported and untreated, leading to high attrition rates and a continuous drain on the healthcare workforce.

In Sub-Saharan Africa, emotional exhaustion exists within a context of extreme resource limitation, high burden of infectious diseases, and often unstable work environments. The emotional toll is fueled by witnessing high patient mortality from preventable conditions, working with minimal equipment, and managing personal safety concerns, including exposure to diseases like Ebola and COVID-19 with inconsistent protective gear. A study in Ethiopia found that 67.5% of nurses working in public hospitals reported high levels of emotional exhaustion, with significant predictors being monthy salary, night shift frequency, and lack of supportive supervision. Research from Nigeria highlighted that over 70% of nurses in tertiary hospitals showed signs of high burnout, with emotional exhaustion being the most pronounced dimension, driven by overwhelming workloads and a perceived lack of institutional value (Mudaly & Nkosi, 2015). The compounding effect of economic hardship and, in some regions, political instability creates a pervasive climate of chronic occupational stress that threatens the very foundation of the healthcare system.

A conceptual analysis of the Digital Health Literacy Instrument (DHLI) score reveals it as a continuous, multidimensional measure of a nurse's ability to seek, find, understand, appraise, and

apply digital health information to address health problems. This continuum reflects not just operational competence but also critical cognitive and evaluative skills necessary for navigating complex health information systems. When linked to the Emotional Exhaustion subscale of the Maslach Burnout Inventory (MBI) which captures feelings of being emotionally overextended and drained by work a clear, inverse relationship is theorized. Specifically, a higher DHLI score, indicating advanced digital literacy, is hypothesized to act as a protective personal resource. This resource likely buffers against the chronic strain induced by digital job demands, thereby predicting lower emotional exhaustion scores (van der Vaart, 2021).

Deficient DHL (very low scores), linked to high emotional exhaustion due to pervasive technostress and helplessness; Functional DHL (low-to-mid scores), associated with moderate but chronic exhaustion from struggling with system inefficiencies and information appraisal; Proficient DHL (mid-to-high scores), correlated with manageable, situational exhaustion where digital tools are seen as challenging yet controllable; and Advanced DHL (very high scores), predictive of the lowest exhaustion levels, where nurses leverage technology for mastery and workflow efficiency, transforming a potential demand into a job resource (Ngien, 2023). Consequently, the DHLI score is not merely a measure of skill but a key indicator of a nurse's psychological risk profile in a digital work environment, where each incremental improvement in literacy may correspond to a non-linear decrease in emotional exhaustion risk.

Problem Statement

The rapid, mandatory digitization of healthcare in tertiary hospitals, while intended to enhance efficiency and safety, has introduced a significant and under-acknowledged occupational stressor that threatens nurse well-being and workforce stability. Nurses, as the primary end-users of complex electronic health records, clinical decision support systems, and telehealth platforms, face an escalating cognitive and emotional burden from these technologies. A critical gap exists in understanding how a nurse's competency in using these tools their Digital Health Literacy (DHL) directly influences their vulnerability to emotional exhaustion, a core dimension of burnout. While preliminary evidence suggests a link between low DHL and higher burnout (García-Izquierdo, 2021), the specific mechanisms such as the mediating role of technostress or the impact of fragmented digital workflows remain inadequately explored in the high-acuity, high-stakes environment of tertiary care.

The problem is compounded by a lack of targeted, evidence-based interventions. Without a clear understanding of this relationship, hospital administrators and nursing leaders cannot design effective strategies to build digital resilience. Consequently, nurses with insufficient DHL are left to navigate poorly integrated systems, experiencing chronic technostress, diminished professional autonomy, and a heightened sense of inefficacy (Farsi, 2022). This not only erodes individual nurse health, leading to increased absenteeism and turnover, but also poses a latent risk to patient safety through increased cognitive load and potential errors. Therefore, there is an urgent need to systematically investigate the nature and strength of the relationship between nurses' DHL and emotional exhaustion in tertiary care settings. Such research is essential to inform the development of protective policies, tailored training programs, and human-centered technology implementations that safeguard nurse well-being and, by extension, the quality and safety of patient care in an increasingly digital hospital ecosystem.

Theoretical Review

Job Demands-Resources (JD-R) Theory

Originated by Demerouti et al. (2001), its main theme is that all work characteristics can be categorized as either job demands (physical/psychological costs) or job resources (aspects that reduce demands and aid goal achievement). Burnout develops from high demands and insufficient resources. Relevance: Digital Health Literacy (DHL) can be framed as a key personal resource that helps nurses manage the high job demand of complex health technologies, thereby buffering emotional exhaustion. Low DHL turns technology into a chronic stressor (Demerouti & Bakker, 2023).

Transactional Model of Stress and Coping

Developed by Lazarus and Folkman (1984), this model posits that stress is a transaction between an individual and their environment, determined by primary appraisal (is this a threat?) and secondary appraisal (can I cope?). Relevance: A nurse's level of DHL directly influences these appraisals. Low DHL leads to appraising digital tasks as a threat to competence and efficacy, while high DHL supports appraising them as manageable, influencing coping and subsequent emotional exhaustion (Monroe & Slavich, 2021).

Conservation of Resources (COR) Theory

Proposed by Hobfoll (1989), its core theme is that individuals strive to obtain, retain, and protect valued resources (e.g., energy, time, personal characteristics). Stress occurs when resources are threatened, lost, or invested without adequate return. Relevance: DHL is a critical resource in modern healthcare. Emotional exhaustion is the result of resource depletion. The constant demand to use digital systems without adequate DHL constitutes a resource threat and loss cycle, whereas high DHL helps conserve and build resources against digital demands (Hobfoll, 2018).

Empirical Review

Lee & Park (2022) purposed of unpacking the psychological mechanism through which digital health literacy (DHL) influences emotional exhaustion, specifically testing the hypothesis that technostress serves as a critical mediator. Their research was driven by the need to move beyond observing a simple correlation and to understand the specific digital stressors that translate low literacy into burnout. The methodology employed was a quantitative, cross-sectional design, administering validated surveys to a purposive sample of 412 registered nurses working in the intensive care units of three large tertiary hospitals in Seoul, South Korea. Instruments included the Digital Health Literacy Instrument (DHLI), the Technostress Scale for Nurses, and the emotional exhaustion subscale of the Maslach Burnout Inventory. Data analysis involved descriptive statistics, correlation analyses, and structural equation modeling to test the direct and indirect pathways. The key finding was that while a direct negative correlation between DHL and emotional exhaustion was confirmed, this relationship was fully mediated by the nurses' experience of technostress. Specifically, nurses with lower DHL reported significantly higher levels of techno-insecurity, defined as fear of making errors with technology, and techno-overload, the feeling of being overwhelmed by constant digital demands. These two dimensions of technostress were the proximal drivers of their emotional exhaustion, explaining nearly all of the variance in the model. Interestingly, general computer self-efficacy did not have the same

mediating effect, highlighting the unique role of health-contextualized digital skills. The study concluded that DHL acts as a shield against the perception of technology as threatening, thereby preventing the activation of the stress response. Based on these findings, the researchers strongly recommend that hospital interventions move beyond generic software training to directly address and mitigate the specific appraisals of technostress. They suggest implementing structured debriefing sessions where nurses can safely discuss technology-related anxieties and near-misses in a non-punitive environment. Furthermore, they advocate for ergonomic and workflow audits to reduce sources of techno-overload, such as redundant alerts or mandatory data entries. Leadership training for nurse managers is also recommended to help them recognize signs of technostress and provide appropriate support. Ultimately, the study positions DHL development as a core component of the hospital's psychological safety strategy for the digital workplace.

García-Izquierdo (2021) investigated whether nurses' pre-existing level of digital health literacy could buffer the negative psychological impact of a major organizational change: the implementation of a new, hospital-wide electronic health record (EHR) system. Their purpose was to provide causal evidence for DHL's protective role during a period of known high stress, thereby informing more effective change management protocols in healthcare. The methodology involved a three-wave panel survey administered to a cohort of 300 staff nurses across four tertiary public hospitals in Spain, with data collection points at one month before the EHR "go-live" date, three months after, and nine months after implementation. They measured DHL using a validated European questionnaire, emotional exhaustion via the Spanish version of the MBI, and controlled for covariates like age, unit, and prior IT experience. Using hierarchical linear modeling, they tracked changes in exhaustion trajectories and tested the moderating effect of baseline DHL. The findings revealed a clear divergence in experience: nurses who scored in the lowest tertile for DHL at baseline showed a sharp, statistically significant increase in emotional exhaustion scores that peaked at three months and remained elevated at nine months. In stark contrast, nurses in the highest DHL tertile reported no significant change in their emotional exhaustion levels throughout the entire ten-month study period, maintaining a stable and lower baseline. The moderate-DHL group experienced a small, temporary increase that partially resolved. This demonstrated that DHL functioned not just as a resource but as a form of "psychological preparedness" for technological disruption. The study concluded that low DHL is a key risk factor for burnout during digital transformation, making certain nurses disproportionately vulnerable. Consequently, the authors offer strong, evidence-based recommendations for policy and practice. They argue that hospital administration must conduct a mandatory DHL assessment for all clinical staff at least six months prior to any major software rollout. This assessment should then inform the creation of stratified training programs, with intensive, hands-on, and unit-specific support targeted to low-DHL nurses. They further recommend establishing a "digital resilience team" of high-DHL nurse champions to provide real-time, peer-to-peer support during the critical first six months post-implementation. Their research makes a compelling case for factoring workforce digital readiness into the project timeline and budget of any EHR transition, framing it as a non-negotiable component of risk mitigation for staff well-being.

Chen (2023) pursued a comprehensive, mixed-methods study with the dual purpose of quantitatively confirming the relationship between DHL and emotional exhaustion in a high-acuity setting while qualitatively uncovering the nuanced, lived experiences and specific digital pain

points that underlie the statistical models. They sought to move from knowing that a relationship exists to understanding why and how it manifests in daily practice, providing rich context for intervention design. Their explanatory sequential methodology first involved distributing a structured survey to 500 full-time nurses across the medical, surgical, and emergency departments of a major academic medical center in Taiwan, measuring DHL, emotional exhaustion, perceived workload, and demographic factors. Following quantitative analysis, they then purposively selected 30 nurses from the survey respondents for in-depth, semi-structured interviews, stratifying the sample to ensure representation from high, medium, and low DHL scorers and a variety of clinical units. The quantitative findings robustly confirmed that lower DHL was a significant independent predictor of higher emotional exhaustion, even after statistically controlling for patient load and overtime hours. The qualitative data, however, provided the powerful narrative: nurses with low DHL consistently described clinical decision support alerts as a source of "daily defeat," expressing anxiety about missing important alerts while also feeling overwhelmed by a constant stream of "stupid" or irrelevant pop-ups that interrupted their workflow. They spoke of fragmented data across multiple platforms, forcing them to act as "human integrators," which consumed cognitive energy and heightened fear of making errors. In contrast, nurses with high DHL described developing personal strategies to filter alerts, customize views, and efficiently synthesize information, framing technology as a tool they controlled. The synthesis of data revealed that the core issue was not the technology itself, but the perceived loss of autonomy and professional judgment it engendered in those with lower literacy. Therefore, the study's recommendations are deeply user-centered. They urge clinical informatics teams to co-design alert systems with frontline nurses, employing a "continuous usability testing" model to reduce alert fatigue and ensure clinical relevance. They recommend training that focuses on workflow integration—teaching nurses how to weave digital tasks seamlessly into patient care—rather than on isolated button-clicking. Furthermore, they advocate for the development and promotion of nurse-friendly data dashboards that aggregate information from disparate sources. The overarching conclusion is that empowering nurses through both improved literacy and better-designed systems is essential to restoring their sense of agency and reducing the digital contributors to exhaustion.

Dubowicz & Schulz (2020) investigated whether the protective relationship between digital health literacy and emotional exhaustion varied across different generational cohorts within the nursing workforce. Their hypothesis was that due to varying levels of formative exposure to digital technology, the importance of DHL as a protective resource would be magnified for older nurses, for whom digital adaptation might represent a steeper learning curve and a greater threat to professional identity. The methodology was a quantitative, cross-sectional survey administered to a nationally representative sample of 450 hospital nurses in Germany, stratified by age to ensure equal representation of Gen Z/Millennials (20-39), Gen X (40-54), and Baby Boomers (55+). They used validated scales for DHL and emotional exhaustion and included measures of general technology acceptance. Data analysis employed moderated regression and conditional process modeling to test if age group significantly altered the strength of the DHL-exhaustion pathway. The core finding confirmed their hypothesis: while a significant negative correlation existed for all age groups, the strength of this protective effect was substantially and statistically stronger for nurses aged 40 and above. For younger nurses, DHL was beneficial but other factors like workload and social support showed stronger direct links to exhaustion. For the over-40 cohort, DHL

emerged as one of the most powerful modifiable predictors of their emotional well-being, suggesting it is a critical resource for mitigating the unique "digital displacement" stress they may experience. The study concluded that a one-size-fits-all approach to DHL support is ineffective and potentially inequitable, as it fails to address the distinct needs of an aging workforce navigating a digital transition they did not grow up with. Their recommendations are therefore explicitly tailored. They propose the development of "generational affinity" DHL support groups, where older nurses can learn in a peer environment that normalizes their challenges and builds confidence. They recommend mentorship programs that strategically pair tech-comfortable younger nurses with experienced older nurses in a reciprocal model that values clinical wisdom while transferring digital skills. Training materials for this cohort should focus on foundational concepts, stress the universality of the learning curve, and explicitly link digital skills to maintaining their high standard of patient care, thereby preserving professional identity. This targeted investment is framed not just as a training issue, but as a strategic retention tool for experienced, veteran nurses whose departure would represent a significant loss of institutional knowledge.

Al-Dwaikat (2023) purposed of testing a comprehensive model that positions digital health literacy not only as a direct personal resource against exhaustion but also as a factor that amplifies the benefits of other workplace resources. They aimed to provide a theoretical understanding of how DHL interacts within the broader ecosystem of nurses' working conditions, particularly in a developing healthcare context. Their methodology was a quantitative, cross-sectional survey of 350 nurses from the medical and surgical wards of two large government-run tertiary hospitals in Jordan. They administered measures for DHL, emotional exhaustion, job demands (e.g., workload, ambiguity), job resources (e.g., supervisor support, autonomy), and work engagement. Data analysis used structural equation modeling to test the hypothesized paths, including both the direct negative effect of DHL on exhaustion and its potential moderating (buffering) effects. The findings provided strong support for their model: DHL was confirmed as a significant personal resource, directly associated with lower emotional exhaustion. More innovatively, the analysis also revealed that DHL acted as a "resource catalyst"; it strengthened the positive relationship between job resources like supervisor support and professional autonomy on the one hand, and work engagement on the other. This suggests that nurses with high DHL are better equipped to leverage the supportive structures around them to stay engaged and motivated. The study concluded that DHL has a dual function—it directly drains the burnout pathway and simultaneously fuels the engagement pathway, making it a uniquely potent factor in the JD-R model for modern nursing. Consequently, their recommendations argue for a systemic, rather than a siloed, approach to DHL. They recommend that nurse managers and hospital administrators integrate DHL development into broader professional development and structural empowerment initiatives, rather than relegating it to the IT department. For example, leadership training programs should include modules on how to support staff's digital competency, and clinical ladder programs could include DHL proficiency as a criterion for advancement. They also suggest that efforts to improve interdisciplinary communication or shared governance should consider the digital platforms that facilitate them, ensuring nurses have the literacy to participate fully. In essence, they advocate for viewing DHL as a foundational enabler of professional practice and empowerment, integral to the overall health of the work environment.

Farsi (2022) focused their research on a previously under-examined aspect of digital health literacy: the specific competency of critically evaluating and appraising the quality, credibility, and applicability of health information found in digital environments. Their purpose was to dissect the DHL construct to determine if certain sub-skills were more powerfully linked to emotional exhaustion than others, particularly in an era of information overload and potential misinformation. The methodology was a quantitative, correlational study using a convenience sample of 280 registered nurses working in a large, urban Canadian tertiary care hospital known for its early adoption of digital tools and clinical analytics. They employed a multidimensional DHL instrument that yielded separate scores for subscales like "navigation," "operation," "information searching," and "evaluation/critical appraisal." These were analyzed alongside the emotional exhaustion subscale of the MBI and measures of information overload. Their key finding was striking: the "evaluation and critical appraisal" subscale emerged as the strongest independent statistical predictor of lower emotional exhaustion scores, even after controlling for overall DHL and other sub-competencies. Nurses who felt confident in judging the reliability of a clinical guideline database, interpreting data from a patient monitoring trend, or assessing a new mobile health app for patients reported significantly lower levels of exhaustion. This suggests that the cognitive burden and anxiety related to sifting through vast amounts of digital data and doubting its validity is a major stressor. The study concluded that in sophisticated digital ecosystems, the ability to filter and trust information is more psychologically protective than simply knowing how to find or input it. Therefore, their recommendations call for a paradigm shift in DHL education. They argue that training must move from operational proficiency to cultivating critical digital thinking, embedding modules on evidence-based practice in digital contexts, source evaluation, and understanding algorithmic bias in clinical decision support. They recommend hospitals create curated, vetted "digital resource hubs" to reduce nurses' exposure to low-quality information and the cognitive load of constant appraisal. Furthermore, they suggest training nurses to become savvy consumers and co-evaluators of the digital tools implemented in their workplace, empowering them to question and improve these systems. This approach frames DHL not as technical compliance, but as an essential component of professional judgment and intellectual resilience in the digital age.

O'Connor (2021) conducted one of the few experimental studies in this domain, with the purpose of establishing causal evidence by testing whether a structured educational intervention designed to boost digital health literacy could directly lead to a reduction in emotional exhaustion among novice nurses. Their aim was to move from observational correlation to intervention-based evidence, providing a model for proactive, preventive training integrated into professional onboarding. The methodology was a cluster-randomized controlled trial conducted across two large affiliated tertiary teaching hospitals in the United States. Newly licensed graduate nurses entering a nurse residency program were randomly assigned by cohort (cluster) to either the intervention group (n=85) or the control group (n=78). The intervention was a 6-week, simulation-enhanced DHL program that went beyond EHR navigation to include modules on data management, privacy, evaluating patient-facing apps, and managing telehealth interactions, all taught within high-fidelity simulated clinical scenarios. The control group received the hospitals' standard EHR onboarding. Emotional exhaustion was measured using the MBI for both groups at baseline (pre-licensure), immediately post-intervention, and at a 3-month follow-up in clinical

practice. The findings provided robust experimental support: while both groups started with similar baseline scores, the intervention group demonstrated a statistically significant reduction in emotional exhaustion scores at the 3-month follow-up compared to the control group, who showed a slight increase. This indicated that the DHL intervention had a durable, protective effect as nurses transitioned into the high-stress reality of hospital practice. The study concluded that DHL is a malleable skill that, when taught in an applied, contextualized manner, can function as a primary prevention strategy against burnout for new nurses. Their recommendations are therefore prescriptive and focused on systemic integration. They argue that comprehensive, simulation-based DHL training should become a mandatory and accredited component of all nurse residency and orientation programs, with dedicated curriculum time and resources. They recommend the development of standardized, evidence-based DHL simulation scenarios that can be shared across institutions. Furthermore, they suggest tracking DHL competency and emotional exhaustion metrics as key outcomes for residency program effectiveness. By framing DHL training as foundational to safe practice and well-being, this study provides a clear blueprint for how hospitals can actively build a more digitally resilient and sustainable nursing workforce from the very start of a nurse's career.

METHODOLOGY

This study adopted a desk methodology. A desk study research design is commonly known as secondary data collection. This is basically collecting data from existing resources preferably because of its low-cost advantage as compared to field research. Our current study looked into already published studies and reports as the data was easily accessed through online journals and libraries.

FINDINGS

The results were analyzed into various research gap categories that is conceptual, contextual and methodological gaps

Conceptual Gaps

While Farsi (2022) highlighted the critical role of the evaluation/appraisal sub-dimension, the relative impact and interaction of other DHL components (e.g., navigation, operation, digital communication, privacy management) on emotional exhaustion remain underexplored. A more granular, component-level analysis is needed to understand which specific digital competencies are most protective against which specific digital stressors. The studies identify poor system design (e.g., alert fatigue, fragmentation) as a source of stress (Chen, 2023) but do not fully integrate this into theoretical models. A gap exists in developing a unified framework that explicitly links organizational-level factors (technology usability, interoperability), individual-level resources (DHL), and the psychological outcome (emotional exhaustion). The JD-R model application by Al-Dwaikat (2023) is a start, but it primarily treats DHL as an individual trait rather than modeling the bidirectional relationship between system quality and literacy development. The research is overwhelmingly deficit-focused, examining how low DHL causes exhaustion. A significant gap exists in exploring how high DHL may actively contribute to positive occupational states like digital fluency, professional empowerment, or innovation engagement, and how these states might

further buffer against burnout. This represents a shift from a pathogenic to a salutogenic perspective within the digital health context.

Contextual Gaps

Lee & Park (2022) focused exclusively on ICU nurses. The digital demands, workflow integration challenges, and types of technostress likely vary significantly across specialties (e.g., oncology, psychiatry, perioperative services, outpatient clinics). The unique relationship between DHL and exhaustion in these diverse clinical environments is largely unexamined, limiting the generalizability of current findings. García-Izquierdo (2021) studied the acute phase of EHR implementation. A gap exists in understanding the role of DHL in the context of long-term, sustained use of mature but ever-evolving digital ecosystems. Does high DHL continue to protect against exhaustion from system upgrades, additive technologies, or cumulative digital debt over a career span? O'Connor (2021) tested a simulation-based intervention for novices. There is a lack of empirical studies evaluating the efficacy of other recommended interventions, such as generational affinity groups (Dubowicz & Schulz, 2020), peer champion models, co-design processes for system redesign (Chen, 2023), or managerial training programs to mitigate technostress. Comparative effectiveness research on different DHL-enhancing strategies is absent.

Geographical Gaps

The reviewed studies are from South Korea, Spain, Taiwan, Germany, Canada, the United States, and Jordan (as an upper-middle-income example). This leaves a vast geographical gap in low- and middle-income countries (LMICs), where digital infrastructure, resource constraints, and cultural approaches to technology adoption differ radically. The relationship between DHL and exhaustion in settings with intermittent connectivity, older technology, or different professional hierarchies is unknown. While individual studies exist from various countries, there are no direct cross-cultural comparative studies. It is unclear how national culture, healthcare system structures, or societal attitudes toward technology moderate the DHL-exhaustion relationship. For instance, the "digital displacement" stress found in older German nurses (Dubowicz & Schulz, 2020) may manifest differently in cultures with different values regarding seniority and technological adoption. Most studies are from mixed or large academic centers. The dynamic may differ in purely public, state-run hospital systems (with potentially different innovation and training budgets) versus competitive private hospital networks. The contextual influence of the fundamental healthcare financing and delivery model on this relationship is an unaddressed geographical and systemic gap.

CONCLUSION AND RECOMMENDATIONS

Conclusions

This study establishes a significant and inverse relationship between nurses' digital health literacy (DHL) and emotional exhaustion within the high-pressure environment of tertiary care hospitals. The findings confirm that DHL is not merely a technical skill but a critical psycho-social resource that buffers against a key dimension of burnout. In settings defined by complex patients, advanced technologies, and relentless pace, a nurse's competency in effectively navigating, evaluating, and applying digital health information and tools directly mitigates feelings of frustration, inadequacy, and chronic strain. Conversely, low DHL acts as a compounding job demand, transforming digital

systems intended to streamline care into persistent sources of stress that erode professional efficacy and well-being.

The implications of this relationship are profound for the sustainability of nursing practice. It moves the conversation beyond viewing technology as a neutral backdrop to recognizing it as an active determinant of workforce health. Investing in the systematic enhancement of nurses' digital health literacy, therefore, represents a dual-purpose intervention: it is both a strategic imperative for safe, efficient, modern healthcare delivery and a necessary safeguard for the emotional resilience of the frontline workforce. Ultimately, fostering a digitally fluent nursing staff is not just an operational goal but a fundamental requirement for preserving human capital in medicine's technological future.

Recommendations

Theory

This research makes a significant contribution to theoretical frameworks in occupational health and nursing science by rigorously integrating digital health literacy (DHL) into established models of workplace stress. Specifically, it extends the Job Demands-Resources (JD-R) model by empirically positioning DHL as a critical personal and organizational resource that can buffer the emotional impact of high-demand digital work environments. The study provides evidence for a novel "digital competence-burnout pathway," suggesting that a nurse's perceived self-efficacy with technology mediates their psychological response to technostress. This moves theory beyond viewing digital tools as passive instruments, reframing them as active agents in the stress process, where mastery (or a lack thereof) directly influences core constructs like professional efficacy and emotional exhaustion. Consequently, the study offers a new, digitally contextualized lens for understanding the modern determinants of nurse well-being, suggesting that coping models must now account for technological proficiency as a fundamental component of professional competence and resilience.

Practice

For hospital administrators and nurse leaders, this study provides actionable, evidence-based strategies to mitigate burnout by targeting a modifiable skill set. The clear inverse relationship between DHL and emotional exhaustion underscores the necessity of moving beyond generic EHR training to implement stratified, just-in-time digital competency programs. Practical interventions should include conducting DHL assessments to identify at-risk staff, creating unit-based "Digital Champion" roles for peer support, and actively involving frontline nurses in the human-centered co-design of clinical software to reduce usability frustrations. Furthermore, the findings mandate integrating discussions of "technostress" into existing wellness programs and formally recognizing technological proficiency in performance evaluations. By investing in tailored DHL development, management can directly address a key source of daily frustration, streamline workflow inefficiencies caused by poor digital fluency, and foster a sense of mastery and control all of which are practical levers for reducing emotional exhaustion and improving job satisfaction at the unit level.

Policy

At the policy level, this research provides a compelling evidence base to advocate for systemic changes that protect the nursing workforce in an increasingly digital healthcare ecosystem. The findings argue for national accreditation bodies, such as the Commission on Collegiate Nursing Education (CCNE), to mandate DHL as a core competency in pre-licensure curricula, ensuring new graduates enter the workforce equipped for its technological realities. For healthcare institutions, the study supports the creation of policies that tie the procurement of new health IT systems to rigorous clinician usability standards and mandated ongoing training budgets. On a broader scale, public health and workforce agencies can utilize this evidence to frame DHL investment as a critical retention strategy, directing grants and funding toward programs that build digital resilience. Ultimately, the research advocates for policy that recognizes a safe and sustainable work environment must now include protection from unmanaged technostress, establishing standards for support and training that view digital literacy not as an optional add-on but as an essential component of occupational safety and professional practice.

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