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Digital QSEN-Based Orientation and Clinical-System Patient Safety Competencies Among Newly Hired Healthcare Professionals in Saudi Arabia

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Abstract

Patient safety training for newly employed healthcare personnel is predominantly administrative and focused on compliance. This provides limited research opportunities to evaluate the improvement of clinical-system safety preparedness from digital onboarding in Saudi Arabian tertiary care. This study assessed the impact of a digitally provided Quality and Safety Education for Nurses (QSEN) based orientation program on the development of specific patient safety related competencies for newly hired healthcare professionals in Saudi Arabian tertiary care. A quantitative quasi-experimental one-group pretest-posttest design was employed. One hundred thirty-two newly hired nurses, physicians, and allied health professionals from King Salman Medical City in Madinah, Saudi Arabia, participated in online modules, virtual simulations, and case-based learning and reflection. Competency was assessed through select domains of the Health Professional Education in Patient Safety Survey and was evaluated through reliability testing, descriptive statistics, and pre-post paired sample analysis, as well as the calculation of the standardized effect sizes. Enhancements were captured in all five domains following completion of the orientation. The study offers novel evidence for interprofessional digital safety onboarding in Saudi tertiary care. The findings can be utilized to develop scalable workforce development models that integrate orientation and the delivery of safety competence.

Key Words: Digital QSEN Orientation, Patient Safety Competence, Clinical Safety, Risk Management, Human Factors, Adverse Event Management, H-PEPSS, Healthcare Orientation, Saudi Arabia

1. Introduction

Patient safety issues indicate the presence of a poorly functioning system. Clinical errors do contribute to patient safety issues, but so do issues such as poorly organized systems and communication, inadequate training staff, insufficient organizational learning, and unclear staff workflows. The World Health Organization (WHO) sees patient safety as a global priority and calls for collaborative efforts to reduce avoidable patient harm across different clinical settings (WHO, 2021). Other recent global reports show that unsafe patient care continues to be a major problem, and a robust measurement system and learning and workforce capability systems must be strengthened

(WHO, 2024). The problem of patient safety is more pronounced among new healthcare workers who are required to use their theoretical knowledge and clinical judgment to ensure safe patient care. New healthcare workers also have to adapt to the policies, systems and technologies, as well as reporting and interprofessional teams in their new work environment.

One can interpret orientation programs with more nuance than simply administrative onboarding practices. When they are developed considering the enhancement of employee ability rather than just the familiarization of procedures, they can serve as organized interventions for patient safety. With the right design, orientation can help the newly recruited staff gain the ability to recognize clinical safety risks and appreciate the relevance of safety in the clinical context and develop appropriate professional and ethical responses to adverse incidents. Orientation programs offered by institutions have a tendency to use lectures, policy briefings, and instruction using a stepwise demonstration of institutional procedures. This may not be enough to assist newly recruited staff in developing the ability to function safely and effectively in a complex clinical system. Especially in the presence of a high volume of clinical staff handovers and the inter-professional collaborative clinical decision-making, newly recruited staff may have to engage with clinical realities beyond orientation. The Quality and Safety Education for Nurses framework offers a conceptual basis for the integration of safety and quality in healthcare education (Cronenwett et al., 2007). Though this model was first developed for nursing, the concepts of safety, improvement, systems, and accountability are relevant to all healthcare disciplines because safe care relies on the collective competence of healthcare professionals.

Digital orientation is a new method of easily accessible patient safety education, training, and reflection. This method applies to experiential learning (Kolb & Kolb, 2017). The importance of this learning theory relates to the competency of identifying risks, understanding the importance of adverse and near-misses, and considering human factors, as it involves reasoning beyond the simple knowledge of a fact. This theory also relates to patient safety education and structured and interactive patient safety education to enhance safety competency (Lee et al., 2022). The competency of patient safety can be improved through simulation of various clinical situations (Bolore et al., 2023). Although the above-mentioned components have gained importance, the application of the digital Quality and Safety Education for Nurses (QSENs) orientation is based on the competencies of patient safety within the Saudi tertiary healthcare contexts, which is yet to be discovered. Hence, this study seeks to understand the implications of the digital orientation within the selected domains of the Patient Safety Survey with a focus on Clinical Safety, Risk Management, Human Factors, Adverse Event Management, and Safety Issues at both the Pre- and Post-Assessment stages.

2. Literature Review and Hypothesis Development

2.1 Patient Safety Competence and Early Professional Transition

Integrated knowledge, skills, attitudes, self-assurance, and professional judgment combine to create the individual elements of patient safety competence. This allows a professional to avoid causing harm to patients, identify conditions that threaten patient safety, express safety concerns, and participate in the safety improvement learning cycle. The competence the newly hired professional needs during the initial phase of the professional practice career goes beyond their knowledge of and ability to perform clinical tasks. Newly hired professionals also need to know how the local support systems, the institutional policies, the systems of communication and reporting, the pressures and demands related to the workload, the physical environment, and the technologies that are used to support care, affect the delivery of safe care. The early phase of professional practice goes beyond the theoretical knowledge that the newly hired professionals learned during their education. The newly hired professional is expected to adapt to the safety culture and the work practices of their employer, and the Health Professional Education in Patient Safety Survey (Ginsburg et al., 2012) was developed for that purpose.

Clinical-system competence in larger tertiary care centers can be diagnosed in new staff working in environments with advanced technologies, multiple points of handover, a variety of patient/operational acuities, staff hierarchies, and interdisciplinary collaboration. Ginsburg et al. (2013) cite evidence of medicine, nursing, and pharmacy graduates' patient safety preparedness as a continuing educational concern more broadly and not as a nursing specific issue. Where the focus of orientation is on the administrative rules, procedural briefings, and a 'walk through' of the institution, the new staff may be left unprepared for the engaged demands of risk management, human factors, reporting, and responding to incidents of poor patient outcomes. Consequently, an orientation model that relates patient safety and clinical practice preparedness is required to help the new staff operationally risk, respond to practice-system and clinical decision-making safety, and unsafe practice within the bounds of the clinical system.

2.2 QSEN as a Competency Framework for Clinical-System Safety

The Quality and Safety Education for Nurses framework was created to enhance the skills needed to elevate quality and safety in healthcare systems (Cronenwett et al., 2007). The framework includes patient-centered care, teamwork and collaboration, evidence-based practice, quality improvement, safety, and informatics. Although

originating in nursing education, the framework's competency structure can be applied to interprofessional safety education. This applies because safe care is the result of collective understanding, practice, and responsibility across healthcare systems. This paper investigates only certain clinical-system safety competencies for the reduction of risk, safety readiness, learning from adverse events, and the improvement of an organization's safety performance for patients. An evaluation of the entire framework is not the main focus of this study.

Adopting this more focused approach is justified because safety competence that enables the performance of basic functions in the complexity of clinical systems is one of the needs of newly employed staff. The selected Patient Safety Survey Safety Education Domains offer a consistent and empirical foundation for the analysis of this competence. Clinical Safety is confidence in the safe practice of care, while Risk Management is the identification and control of risks. Human Factors is the interaction of people, systems, and organizational and environmental elements. Adverse Event Management is the ability to report and analyze safety incidents to improve the system, and Broader Safety Issues is the awareness of safety and the system's responsibility in the organization. The five domains outlined above constitute a relevant and practical safety profile of the clinical system of newly employed staff who have to adjust to the local routines of reporting, interprofessional and, most importantly, organizational safety and patient safety practices.

2.3 Digital Experiential Orientation as the Educational Mechanism

The experiential orientation model engages learners with exposure to applied clinical work while offering them content scaffolding. The model starts with an online module that the learners review on their own, followed by a series of virtual simulation modules that guide them through various clinical scenarios. Paired with formative assessments, reflective activities, and a structured onboarding approach, the model aims to develop an essential but often underserved competence of patient safety. New healthcare employees must be able to think critically to remain safe, which the orientation model seeks to bridge. The model offers a safe space for the healthcare employees to recognize, anticipate, and respond to unsafe situations that may occur when first interacting with a workplace environment. Safety principles and real-world application are integrated, developing a necessary healthcare orientation and patient safety. The design follows Kolb's (2017) experiential learning theory, describing professional learning as a perpetual cycle of experience, reflection, conceptualization, and active application. In safety education, learners must be able to analyze clinical situations rather than memorizing an organization's mundane policies. The patient safety education model supports reflective, interactive learning and simulation (Lee et al., 2022).

The use of simulation and case-based learning techniques is particularly valuable when talking about clinical-system safety, as they offer learners the opportunity to analyze the ways in which system-level conditions interact with individual-level behaviors to produce errors. A systems perspective on safety explains that unsafe acts should be evaluated, in part, in relation to the design of the system, the communication and work pressures, fatigue, the use of technology, and the limits of the organization (Reason, 2000). Considering this, a digital Quality and Safety Education for Nurses orientation program offers novice employees the opportunity to step away from the practice and culture of placing blame for errors and helps develop an understanding that encourages recognition of risk, the reporting of incidents, and learning from adverse outcomes to improve systems. The importance of this approach to Human Factors and Adverse Event Management lies in the understanding that the design of the organization, coupled with the demands of communication and work processes that are mediated by technology, also affects the opportunity for harmful outcomes to occur. As a result, digital experiential orientation forms a practical, scalable means of putting the principles of patient safety into practice at the clinical-system level during the great initial transition into professional practice.

2.4 Conceptual Framework

The framework suggests that an online orientation program for the Quality and Safety Education for Nurses (QSEN) is indicative of newly employed healthcare workers acquiring competencies in five clinical-system domains of patient safety. The online program is the educational intervention, while the outcomes of the competencies are Clinical Safety, Risk Management, Human Factors, Adverse Event Management, and Safety Issues. The framework integrates the intervention, the outcomes, the assumptions, and the analysis of the safety readiness for the early phase of the professional shift. The framework is to be understood as an improvement model associated with the intervention, and not as a causal model, due to the one-group pretest/posttest design of the study. The digital orientation program and the five patient safety competency outcomes are depicted in Figure 1.

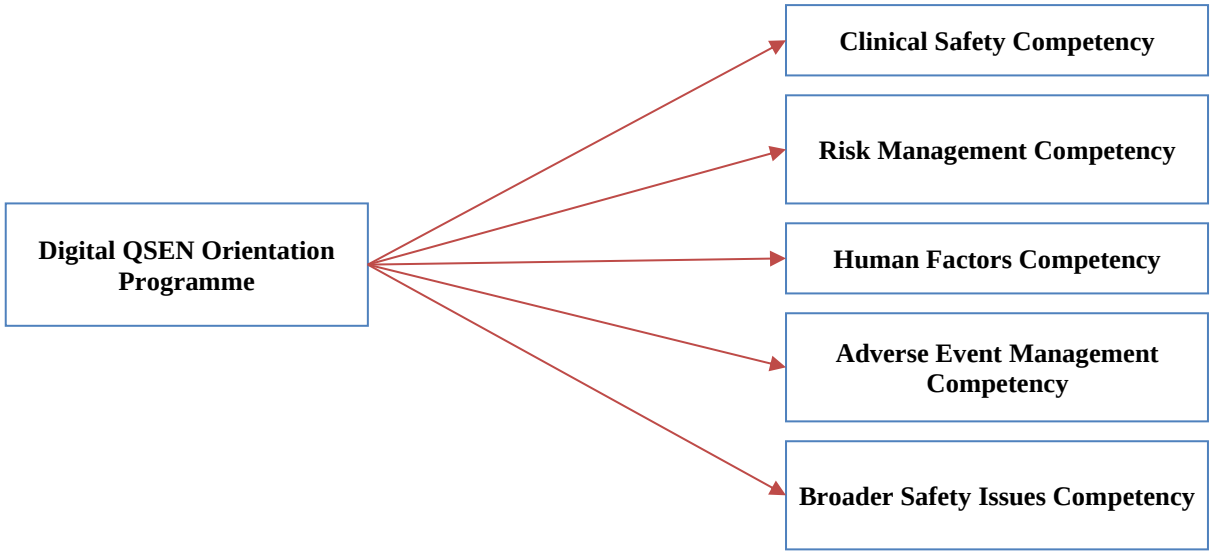

Figure 1. Conceptual framework

2.5 Hypotheses

The hypotheses focused on the potential for measurable improvement resulting from participation in the digital orientation program. This is based on the Quality and Safety Education for Nurses framework and the one-group pretest-posttest design of the study. The hypotheses are related to specific outcome domains of the conceptual framework and the applicable Health Professional Education in Patient Safety Survey domains of the study, including the anticipated statistical analysis and result interpretation.

H1: Participation in the digital Quality and Safety Education for Nurses orientation programme is associated with a significant improvement in Clinical Safety Competency.

H2: Participation in the digital Quality and Safety Education for Nurses orientation programme is associated with a significant improvement in Risk Management Competency.

H3: Participation in the digital Quality and Safety Education for Nurses orientation programme is associated with a significant improvement in Human Factors Competency.

H4: Participation in the digital Quality and Safety Education for Nurses orientation programme is associated with a significant improvement in Adverse Event Management Competency.

H5: Participation in the digital Quality and Safety Education for Nurses orientation programme is associated with a significant improvement in Broader Safety Issues Competency.

3. Methodology

3.1 Research Design

A quantitative study that is a quasi-experimental, single group pretest/posttest study design was used. This type of study design was appropriate in this case because of the context that was referenced. In this case, it was not feasible to randomly assign as all new staff needed to attend the same Onboarding programme. Despite this type of study design, competing alternative explanations offer incomplete constraints to maturity, testing, familiarity with the instrument and at the same time, the organization. For these reasons, the outcome is understood as the intervention led to improvement and not as the alternative (Shadish et al., 2002). This type of study design does have the capability of identifying significant outcomes and does offer some credibility; however, the extent is not indicative of controlled quasi-experimental design and randomized design.

3.2 Setting, Participants, and Sampling

This research took place at King Salman Medical City in Madinah, Saudi Arabia, an appropriate setting since the facility offers specialized health services and has the requisite training and simulation resources to aid in the development of digital, simulation, and competency-based training programs. A purposive sampling technique was used to select newly recruited staff members who were targeted by the digital Quality and Safety Education for Nurses program and who completed both pre and post assessment tasks. Of the 132 participants who were included in the final analytical sample, 60.6% were female, and 39.4% were male. Also, the sample consisted of 57.6% of participants who had less than one year of clinical practice, thus mainly representing health professionals in the early transition to practice period.

Newly hired health staff members who were part of the institutional orientation program, who were exposed to the digital training, and who were available to respond to both measurement tasks were included. Participants who did not complete both the pre and post assessments were removed from the final sample. This was an appropriate sampling technique for an assessment of an in situ onboarding intervention; however, because the sample was from one institution and not a random sample of the Saudi Health staff, this small sample was not meant to be representative, thus the findings will be limited in scope and scale.

3.3 Digital QSEN Orientation Programme

The intervention was composed of an electronically delivered orientation program that included the Quality and Safety Education for Nurses and was intended to improve knowledge, confidence, and the readiness for the application of patient safety among health care professionals newly recruited. The program comprised online learning modules, a virtual simulation, scenario-based activities, case-based learning, and reflective exercises. The components aimed to help learners connect patient safety concepts to the clinical-system safety issues of risk identification, human factors, reporting, and escalating incidents, learning from adverse events, and safety accountability within the organization. The digital format of case modules allowed participants to engage with safety issues applicable to clinical practice that are encountered during the practice of the program, and ensured the consistent inclusion of the core safety content in the program.

The program focused on framework building competencies instead of implementing a traditional information-based activity. Online modules introduced the four concepts of patient safety and the participants' roles and responsibilities within their institution. Virtual simulation and scenario-based activities encouraged participants to actively interpret risk and determine the best response to maintain safety. Case-based learning challenged participants to understand the system's role and design in the context of safety, as well as the orientation, and to fulfill their clinical accountability. This program design is aligned with the Quality and Safety Education for Nurses framework and with the Safety attitude, knowledge and skills (Cronenwett et al., 2007). It also demonstrates what is generally an accepted framework for patient safety learning. It advocates for understanding system safety and preparedness for practice, as opposed to relying on the cognitive memorization of policy (Lee et al., 2022).

3.4 Instrument

Patient safety competence was evaluated by using some domains of the Health Professional Education in Patient Safety Survey. This survey assesses health care professionals' patient safety competence perceptions at the entry points in their practice and has been used in different contexts in health care professional education (Ginsburg et al., 2012). For this study, five clinical-system domains were analyzed: Clinical Safety, Risk Management, Human Factors, Adverse Event Management, and Broader Safety Issues. As a part of the analysis, the mean scores in the domains were calculated and used for further statistical analysis, with higher scores indicating greater competence perceptions in the respective patient safety domains.

The choice of the domains was purposeful in that the study was interested only in the clinical-system safety readiness, as opposed to the other patient safety dimensions that are related to interpersonal and cultural dimensions, as well as communication. Therefore, the evaluation of the selected domains was done independently for the pretest and the posttest. This helped to assess the selected domains for their internal consistency and allowed interpreting changes in mean scores in the selected domains.

3.5 Data Analysis

Five domains specific to patient safety in clinical systems were selected. Reliability estimation and data analysis on these domains were performed. To assess the internal consistency, Cronbach's alpha was computed. Following Nunnally and Bernstein's recommendations (1994), alpha levels equal to or greater than 0.70 were accepted. Results for pretests and posttests were organized and described statistically in terms of means and standard deviations. Following this, a paired sample t-test was applied to each of the domains to check the significance of the posttest scores when compared to the pretest scores. Within-participant, pretest-posttest comparison effect sizes were reported as Cohen's dz. It was computed as $t/\sqrt{n}$, where n is the total number of observations (Lakens, 2013). Finally, considering Cohen's (1988) recommendations, benchmarks for dz were used to interpret effects. Values equal to or greater than 0.80 were regarded as large. Cohen's (1988) benchmarks were used conservatively.

3.6 Ethical Considerations

This study aligned with the balancing principles of research ethics and school-based evaluation of health professionals. Participants were briefed on reasons of the assessment, that the study measures were to be taken entirely voluntarily, and that their answers would be treated with utmost confidentiality. All data were publicly reported and analyzed in bulk, and no identifying data were collected. These measures, in particular, were very important as the participants were the newly hired staff of the institution, and it is possible that response honesty was compromised because of the pressure to participate. Maintaining the respondent's professional confidentiality

was designed to minimize perceived pressure, and to protect the respondents' professional privacy, thereby facilitating accurate self-assessment regarding the respondents' competency in relation to the safety of the patients.

4. Results

4.1 Reliability of Clinical-System Domains

According to Table 1, the five selected clinical-system domains exhibited a range of internal consistency from acceptable to excellent across both pretest and posttest measurements. These results confirmed that the selected Health Professional Education in Patient Safety Survey subscales are reliable for evaluating the patient safety competence of newly employed healthcare professionals. Reliability coefficients demonstrated a firm basis for the assessment of mean scores of clinical-system domains over time. Clinical Safety and Broader Safety Issues exhibited the highest posttest reliability, with Cronbach's alpha scores of .91 and .92, respectively. Risk Management and Adverse Event Management also exhibited good internal consistency at both measurement points. Human Factors exhibited a moderate level of pretest reliability, which improved to good posttest reliability. The results in Table 1 confirm the reliability of measurement domains used in the study.

Table 1. Reliability coefficients for selected clinical-system H-PEPSS domains

Domain	No. of items	Cronbach's alpha (Pretest)	Cronbach's alpha (Posttest)	Interpretation
Clinical Safety	4	.86	.91	Excellent
Risk Management	3	.82	.88	Good
Human Factors	3	.79	.85	Acceptable
Adverse Event Management	4	.84	.89	Good
Broader Safety Issues	7	.88	.92	Excellent

4.2 Pretest and Posttest Descriptive Results

As indicated in Table 2, mean scores for all five clinical-system patient safety domains increased after completing the digital Quality and Safety Education for Nurses orientation programme. The biggest mean difference was found in Broader Safety Issues, where the mean increased from 3.22 in the pretest to 4.38 in the posttest. An increase from 3.10 to 4.22 was also noted in Clinical Safety. Risk Management also showed an increase where the mean of the posttest was 4.10 as compared to 3.00 for the pretest. The lowest mean score in the pretest in Human Factors, was at 2.95, and in the posttest, had a mean of 4.00. Similarly, Adverse Event Management showed a mean increase from 3.15 in the pretest to 4.22 in the posttest. The overall descriptive results for the domains in Table 2 shows an improvement in clinical safety practice, risk, and safety systems and responsibilities, adverse event learning, and an understanding of Human Factors.

Table 2. Pretest and posttest scores for selected clinical-system domains

Domain	Pretest M	Posttest M	Mean difference	SD (Pretest)	SD (Posttest)
Clinical Safety	3.10	4.22	+1.12	0.68	0.54
Risk Management	3.00	4.10	+1.10	0.73	0.59
Human Factors	2.95	4.00	+1.05	0.74	0.58
Adverse Event Management	3.15	4.22	+1.07	0.70	0.56
Broader Safety Issues	3.22	4.38	+1.16	0.67	0.55

4.3 Paired-Sample t-Test Results

The results of the paired-sample t-test shown in Table 3 suggested a positive statistically significant difference in the evaluation of all five clinical-system patient safety competency domains following the completion of the digital Quality and Safety Education for Nurses orientation programme. Improvements in all domains were statistically significant at $p < .001$, and the posttest scores were higher than the pretest scores. The effect size for the paired samples was large in all domains, suggesting the observed improvements were evident, statistically significant, and meaningful. The largest effect was in the Clinical Safety domain, closely followed by the Broader Safety Issues domain. Adverse Event Management, Risk Management, and Human Factors also showed large effects, suggesting

a positive statistically significant difference in both safety practices and patient safety competencies at the system level.

Table 3. Paired-sample t-test results for selected clinical-system domains

Domain	t	df	p	Cohen's dz	Interpretation
Clinical Safety	15.82	131	< .001	1.38	Large effect
Risk Management	13.45	131	< .001	1.17	Large effect
Human Factors	12.82	131	< .001	1.12	Large effect
Adverse Event Management	13.78	131	< .001	1.20	Large effect
Broader Safety Issues	15.64	131	< .001	1.36	Large effect

4.4 Hypothesis Testing Summary

Table 4 summarizes the data, which confirmed all five hypotheses. Each safety competency domain exhibited significant improvements from pretest to posttest after attending the digital Quality and Safety Education for Nurses orientation program. This improvement indicates the program enhanced the perceived clinical-system patient safety readiness for newly hired healthcare professionals. The improvement across all five domains indicates the program enhanced not only the clinical safety practices, risk management, and clinical human factors, but the management of adverse events and the safety of systems at all levels.

Table 4. Hypothesis testing summary

Hypothesis	Competency domain	Statistical result	Decision
H1	Clinical Safety	Significant improvement, p < .001	Supported
H2	Risk Management	Significant improvement, p < .001	Supported
H3	Human Factors	Significant improvement, p < .001	Supported
H4	Adverse Event Management	Significant improvement, p < .001	Supported
H5	Broader Safety Issues	Significant improvement, p < .001	Supported

5. Discussion

5.1 Interpretation of Clinical-System Competency Gains

There was an observable advancement in all the mentioned domains regarding the clinical system and patient safety competency domains. This was post attendance to the digital Quality and Safety Education for Nurses orientation program. The growth in Clinical Safety implies that the program improved participants' perceived capacity to implement safety practices during the initial stages of clinical work. This discovery carries significant weight. It is common for newly employed members of the health workforce to need formal and structured assistance in order to convert their knowledge of patient safety into everyday safe clinical decisions. The magnitude of the advancement also suggests that orientation can go beyond merely meeting administrative requirements, provided that it is designed with intention towards developing specific competencies in relation to real clinical-system issues.

The intervention also resulted in notable progress in Risk Management and Human Factors. Meaningfully, both domains necessitate practitioners to recognize risk patterns and think ahead about potentially hazardous situations by integrating fatigue, workload, communication, technology, and the workplace environment as they impact the work situation. Additionally, most baseline means indicate the need for greater focus in areas of orientation and continuing professional development. Improvement in Human Factors is promising given that this domain had the lowest baseline mean. This is in line with the systems approach to patient safety, which focuses on the domain of human performance and situates it in the context of the conditions under which care is rendered, rather than relying on individual provider vigilance (Reason, 2000).

The enhancements of Adverse Event Management and Broader Safety Issues demonstrate that the program bolstered the participants' procedural confidence. The participants' perceived competence of identifying, recording, and most importantly, learning from adverse events, improved alongside the participants' understanding of safety as an organizational and system-level concern. The findings coincide with the global patient safety frameworks which center on learning and the structured, transparent, and cohesive organizational efforts to minimize preventable harm (World Health Organization, 2021). The latest updates of global patient safety emphasize the importance of stronger evaluation measures and the development of the workforce's capability and learning systems within the organization (World Health Organization, 2024). From a practical standpoint, these improvements mean that digitally oriented safety frameworks provide new employees with an understanding of the safety systems integrated into clinical practice. These frameworks include reporting pathways, learning and policy systems, and safety and ethical escalation within clinical practice.

5.2 Relationship to Previous Research

The results of this study corroborate existing research that demonstrates enhanced safety-related learning outcomes and elevated levels of perceived safety-related knowledge due to safety education. In the study by Torkaman et al. (2022), the education of safety patients resulted in the improvement of some competencies in the Health Professional Education in Patient Safety Survey among the student nurses, and the improvement of the various domains was inconsistent. In the study by Bolore et al. (2023), it was found that the professional interservice training with the simulation facilities improved the safety skills of the health professionals and the continuous support and repeated training were very important. This study further provides evidence to this work and examines the case of new healthcare professionals within a Saudi tertiary-care context and evaluates a digital Quality and Safety Education for Nurses and Safety Education for Nurses framework orientation rather than traditional classroom pedagogy.

This study supports the opinion that digital and simulation-based safety education improves the quality and safety of healthcare services when patient safety learning involves applied reasoning and the ability to interpret different scenarios. According to Lee et al. (2022), the use of safety education modeling and teaching improves patient safety. This study also supports the use of the orientation framework in the integration of online modules, virtual simulations, and activities and cases for analysis and reflection. However, this study cannot confirm if the positive outcomes were due to the digital format, the Quality and Safety Education for Nurses framework, the simulation activities, or a combination of the framework and the design of the program. Hence, future studies should be comparative in order to examine different components of the safety education and the simulation framework, and the activities and safety education, and evaluate the safety in order to maintain safety in healthcare consistent with the activities and safety education.

5.3 Theoretical Contribution

This study expands knowledge in patient safety education by showing the application of the Quality and Safety Education for Nurses framework within a digital orientation model for newly hired interprofessional healthcare workers. Traditionally, the framework has associations with nursing education. The data indicates that the framework’s competency logic may be adaptable beyond nursing education to other professions. This study focuses on the orientation of healthcare workers within clinical-system safety areas. The importance of this study stems from the understanding that the safety of patients is a shared comprehension and responsibility, as well as a concerted effort and a system-based concern, from nurses, physicians, and allied healthcare professionals. This is even more so within large healthcare institutions. Orientation programs within large healthcare workplaces should foster a collective safety language that enables new employees from various disciplines to recognize risk, respond to unsafe conditions, and participate in safety practices.

The results bolster the theory of experiential learning within digital healthcare orientation. Participants interacted with online modules, virtual simulations, case studies, and reflection-based activities, wherein they identified safety issues, framed them theoretically, and applied them to real-world clinical cases. The learning cycle espoused falls within the scope of patient safety and professional judgment, system thinking, and the application of risk and safety, which is distinct from the Passive Zone of Kolb’s and Kolb’s (2017) experiential learning model. It is evident that the Quality and Safety Education for Nurses framework, along with other competency frameworks, subsume interactive, experiential learning. This assertion is valid, as digital orientation has the potential to construct the clinical and system-based safety competencies required of learners, during the initial training period.

5.4 Practical and Policy Implications

Digital Quality and Safety Education for Nurses orientation was shown to offer an innovative solution to healthcare institutions in implementing patient safety training that was flexible and scalable while allowing for greater standardization across disciplines. That is particularly helpful in large healthcare organizations where safety training for new employees may literally be organized and planned when new employees on separate tracks enter the healthcare facility at different journey stages. Digital orientation model offers the advantage of tracing

completion and allowing recurrent access to learning materials, as well as greater integration of the preparation of onboarding materials to the organization's patient safety concerns. Digital orientation may be both an educational intervention and a quality support system at the organization.

The results underscore for training departments the value of including simulation, case-based learning, and reflective debriefing in orientation, rather than depending mostly on policy presentations. Practical learning activities, especially in the domains of Risk Management, Human Factors, and Adverse Event Management, are more pertinent because these fields deal with interpreting, judging, and responding to various situations that arise in clinical practice. Orientation programs should incorporate activities in which newly hired staff members will identify risks and choose appropriate pathways for escalation, explain human factors, and give further consideration to the system's potential role in adverse events. Such activities are likely to enhance the connection between knowledge of patient safety and the initiation of clinical decisions.

For Saudi Arabian policymakers and healthcare leaders, the study complements national health transformation priorities by integrating digital education with training, workforce capability, and quality improvement. The Health Sector Transformation Program emphasizes quality, efficiency, digital tools, and human resource development as priorities of Saudi Vision 2030 (Saudi Vision 2030, 2021). Recent assessments of Saudi Arabia's health sector reform have noted the importance of readiness of stakeholders and transformation at the system level for the attainment of the country's health goals (Al-Nozha, 2024). In this regard, digital patient safety orientation can be seen as a practical human resource development approach that supports the system's integration of workforce and enterprise-wide healthcare transformation initiatives.

6. Limitations and Future Research

The first limitation is that the one-group pretest-posttest design does not include a comparison group. As such, we can only speculate that the changes experienced by the participants were due to the digital orientation program and not due to other factors such as the effects of testing, maturation, exposure to the institution, learning, etc. In this study, we recognize the concurrent experiences that were occurring during this study and the possible effects on the measurement. We can only speculate that the study results show positive changes due to the intervention and not due to other factors. Future studies should incorporate the design used in this study to provide stronger causal interpretation.

The second limitation is self-reported patient safety competence. While H-PEPSS is a recognized tool, perceived competence is unlikely to represent clinical actions and safety behaviours. Participants may feel more confident post-orientation, but that is not an indication of patient safety principles being practised. Studies in the future ought to combine self-report techniques with objective assessments within the context of a safety simulation, supervisor assessments, safety knowledge tests, assessed behaviour after reporting incidents, and performance indicators within the context of a practice in order to ascertain whether improvements in perceived competence are reflected in patient safety behaviours within the context of clinical safety.

Another additional limitation is the research was conducted at a single institution. This creates challenges when seeking to generalize the findings to other Saudi healthcare organizations with disparate cultures, resources, workforce configurations, and levels of digital preparedness. Research conducted across multiple sites may present a more holistic view of the digital orientation models across varied healthcare environments and workforce assemblies. Competency retention post intervention, as well as the impact of refresher modules and repeat sessions of structured simulation and debriefing on retention, are pertinent research topics. Analyses of work specialties along with career and experiential levels of the healthcare workforce may inform further, differentiated gains, primarily among nurses, physicians, and allied health personnel.

7. Conclusion

The study showed a digital Quality and Safety Education for Nurses-based orientation program led to statistically significant and educationally substantial improvements in five clinical-system patient safety competencies among new staff in Saudi Arabia. The greatest improvements were seen in Clinical Safety and Broader Safety Issues. Positive changes were seen in Risk Management, Human Factors, and Adverse Event Management. Digital experiential orientation programs have the potential to enhance the practice readiness of new professionals to recognize risks, learn from adverse events, and develop a systems-based thinking approach to patient safety. It should be noted that the study used a one-group pretest-posttest design and relied on self-reported competence. Thus, the results should be interpreted with caution and validated by future controlled, multi-site studies that utilize objective measures of performance. The study informs healthcare orientation, patient safety education, and the Saudi health workforce by demonstrating the value of a competency-based digital orientation program in developing clinical-system safety competencies of new professionals.

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