

PROGRAM EVALUATION OF VIRTUAL RN (ViRN) INTEGRATION: ASSESSING
ADOPTION, QUALITY PROCESS, AND NURSE SATISFACTION IN INPATIENT
CARE

by

Joannie Elizabeth Schmidt

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As members of the DNP Project Committee, we certify that we have read the DNP project prepared by Joannie Elizabeth Schmidt, titled Program Evaluation of Virtual RN (ViRN) Integration: Assessing Adoption, Quality Process, and Nurse Satisfaction in Inpatient Care, and recommend that it be accepted as fulfilling the DNP project requirement for the Degree of Doctor of Nursing Practice.

Cindy Rishel
Cindy Rishel (Nov 6, 2025 10:08:05 MST) Date: 11/06/2025
Cindy J. Rishel, PhD, RN, OCN, NEA-BC

Cheryl Lacasse
Cheryl L. Lacasse, PhD, RN, AOCNS Date: 11/06/2025

Lisa Archer
Lisa Archer (Nov 6, 2025 11:37:00 CST) Date: 11/06/2025
Lisa M. Archer, DNP, MBA, RN, NE-BC

Final approval and acceptance of this DNP project are contingent upon the candidate's submission of the final copies of the DNP project to the Graduate College.

I hereby certify that I have read this DNP project prepared under my direction and recommend that it be accepted as fulfilling the DNP project requirement.

Cindy Rishel
Cindy Rishel (Nov 6, 2025 10:08:05 MST) Date: 11/06/2025
Cindy J. Rishel, PhD, RN, OCN, NEA-BC
DNP Project Committee Chair
College of Nursing



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LAND ACKNOWLEDGEMENT

We respectfully acknowledge the University of Arizona is on the land and territories of Indigenous peoples. Today, Arizona is home to 22 federally recognized tribes, with Tucson being home to the O'odham and the Yaqui. Committed to diversity and inclusion, the University strives to build sustainable relationships with sovereign Native Nations and Indigenous communities through education offerings, partnerships, and community service.

DEDICATION

I dedicate this work to my husband, Kevin, and my children, Kristen and Mitchell, whose unwavering support and understanding sustained me through the many times I said, “I have homework.” Their encouragement has been invaluable, and I could not have accomplished this journey without them. It is my hope that I have shown my children that education is always possible, at any stage of life.

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Abstract

Background: The increasing complexity of healthcare and persistent nursing shortages have driven the adoption of creative care models such as the Virtual Registered Nurse (ViRN). ViRN leverages telehealth technology to provide remote clinical assistance, patient monitoring, and education to support the bedside nurses in acute care settings. By offloading admission, discharge, and patient education tasks, ViRN aims to enhance workflow efficiency, improve patient and nurse satisfaction, and medication safety.

Purpose: This project evaluated the ViRN program at an academic medical center health system hub site, focusing on four objectives: adoption of ViRN for admissions and discharges, impact on heparin medication safety, nurse satisfaction, and overall integration into inpatient workflows. The goal was to assess the effectiveness of ViRN in optimizing nursing processes and supporting evidence-based program refinement and expansion.

Methods: A qualitative and quantitative evaluation with descriptive statistics was conducted across three medical-surgical units (72 beds total). Quantitative data included electronic health record (EHR) reports on ViRN-assisted admissions/discharges and safety event records for Heparin administration. Nurse satisfaction was measured via an anonymous survey (Likert scale and open-ended questions). Qualitative thematic analysis captured nurses' experiences and suggestions. All data were de-identified, and Institutional Review Board (IRB) approval was obtained.

Results: From May 2023 to May 2025, ViRN assisted with 62.7% of admissions and 23.1% of discharges, with unit-level variability. Heparin safety events decreased post-implementation, with ViRN providing critical "good catches" and protocol adherence. Surveyed nurses (59%

response rate) reported high satisfaction with ViRN's accessibility, workflow support, and time-saving benefits, though some cited challenges with technology and role clarity. Overall ViRN utilization reached 41.9%, indicating moderate integration.

Conclusions: ViRN integration improved workflow efficiency, medication safety, and nursing satisfaction in inpatient care. While adoption for admissions was high, discharges and overall utilization varied by unit, highlighting opportunities for targeted improvement. Continued monitoring, staff engagement, and communication enhancements are recommended to maximize ViRN's impact and scalability.

Background

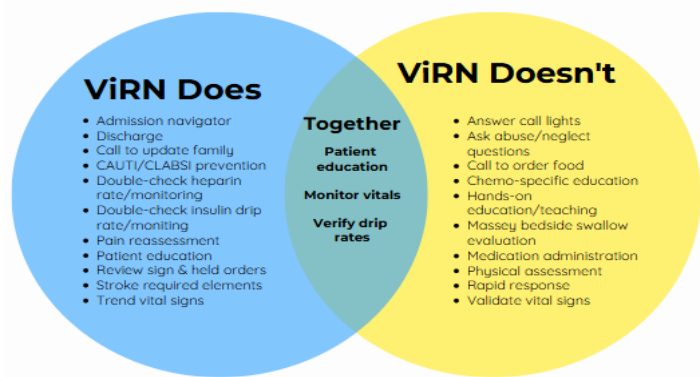
The healthcare landscape is becoming increasingly complex, necessitating innovative solutions to support nursing professionals more efficiently and effectively (Tibbe et al., 2023). Acute care virtual nursing uses telehealth to deliver remote nursing expertise and assistance, enabling seasoned nurses to help patients and bedside nurses remotely via video conferencing to enhance care and remote observations. In response to inpatient care demands and constrained nursing resources, Virtual Registered Nurse (ViRN) roles assist bedside Registered Nurses (RN) and patients in general medical-surgical (medical/surgical) care units by delivering real-time virtual clinical guidance, patient monitoring, and implementing best practices (Roberson et al., 2023). Using telehealth technology, “virtual nurses” can provide patient education and complete nursing tasks at the patient's bedside, freeing up the bedside nurses’ time for activities requiring in-person care (DiCello et al., 2024). Virtual nursing provides remote care and support, enhancing the overall quality and preventing errors by “good catches” of near misses or potential errors (Schuelke et al., 2019).

The ViRN model is designed to enhance patient satisfaction, staff satisfaction, physician satisfaction, patient quality metrics, and organizational financial metrics (Schuelke et al., 2019). The academic medical center Enterprise comprises three large academic sites and one health system, which comprises smaller medical hub hospitals. ViRN focuses on offloading specific nursing tasks and supporting clinical quality measures by handling responsibilities that do not require in-person patient interactions. The ViRN programs’ roles include admission and discharge navigation, patient education, and quality assistance, all enabled through virtual care technology. The academic medical center’s Enterprise ViRN program employs 100 RNs

throughout large academic and health system sites. They work 50% of their full-time equivalent (FTE) on the inpatient floor as staff nurses to maintain experience and clinical nursing practice competency, providing direct, hands-on patient care, and the other FTE portion within the ViRN program.

The academic medical center's ViRN program was first implemented in a general medical unit in one of the large academic sites in November 2020. Currently, ViRN supports three of the four health system hub sites and two large academic sites.

ViRN nurses can cover any medical/surgical unit across any site with a ratio of one ViRN per 50 beds from 7 am to 11 pm, and one ViRN per 200 beds from 11 pm to 7 am. ViRN emphasizes an integrated care team model that minimizes direct care duplication. ViRN nurses do not perform tasks that require hands-on interaction, such as abuse and neglect inquiries, ordering food, chemotherapy education, bedside swallow evaluations, medication administration, physical assessments, rapid response/code blue interventions, or validating vital signs. Instead, the program supports nursing, safety, and quality assurance functions essential to optimizing patient outcomes, such as admission and discharge navigator completion, patient education, and supporting and mentoring nurses. Figure 1 denotes the ViRN responsibilities versus the bedside nurse responsibilities and those that are shared.

Figure 1*Virtual Care and Bedside Team-Sharing Responsibilities*

A survey by Ransford et al. (2024) found that 77% of nurses spend over three hours per shift on admissions, discharges, and patient education, increasing workloads and limiting direct patient care. Integrating ViRN technology can reduce this burden by delegating routine admission, discharge, and education to ViRN. The delay in patient discharge can significantly impact the patient throughput due to staffing and workload challenges (Perpetua et al., 2023).

ViRN was implemented at one of the health system's hospital hub sites on May 18, 2022, on a medical/surgical unit. Continuous rolling implementation on additional medical/surgical units on June 1, 2022, and completion on the last medical/surgical unit on June 27, 2022.

The purpose of this project was to complete a program evaluation of the ViRN program at one health system hub site, using the following criteria: adoption process for admissions and discharges, quality of Heparin administration, nurse satisfaction, and overall program utilization.

CDC Program Evaluation Framework

According to the U.S. Centers for Disease Control and Prevention (CDC) (CDC, 2024), the Program Evaluation Framework (PEF) provides a structured approach for designing and implementing evaluations across diverse programs and settings, both within and outside public

health. Central to this framework are cross-cutting actions—foundational principles that should be integrated throughout all evaluation stages, with collaborative engagement identified as a critical component. It can be utilized to construct evidence, comprehend programs, and enhance evidence-based decision-making (CDC, 2024).

The CDC's PEF includes three cross-cutting actions, five evaluation standards, and six evaluation steps that guide the steps of a program evaluation. A visual representation of the CDC's PEF is noted in Figure 2 below. Furthermore, it systematically guides a program evaluation to establish evidence, comprehend programs, and enhance evidence-informed decision-making (CDC, 2024). According to the CDC (2024), the program evaluation helps answer questions regarding program implementation, effectiveness, attribution, contribution, and efficiency.

The CDC framework was selected due to its practicality and nonprescriptive nature, effectively organizing and summarizing the components required for program evaluation.

The three cross-cutting actions are:

1. Engage Collaboratively
2. Advance Equity
3. Learn from and Use Insights.

The five evaluation standards for quality evaluation include:

1. Relevance and Utility
2. Rigor
3. Independence and Objectivity
4. Transparency

5. Ethic

Finally, the six steps for program evaluation are:

1. Assess the Context
2. Describe the Program
3. Focus on the Evaluation Questions and Design
4. Gather Credible Evidence
5. Generate and Support Conclusions
6. Act on Finding

These steps provide a summary of the program and facilitate understanding of its context to improve how evaluations are completed (CDC, 2024).

Figure 2

CDC Program Evaluation Framework Graphic

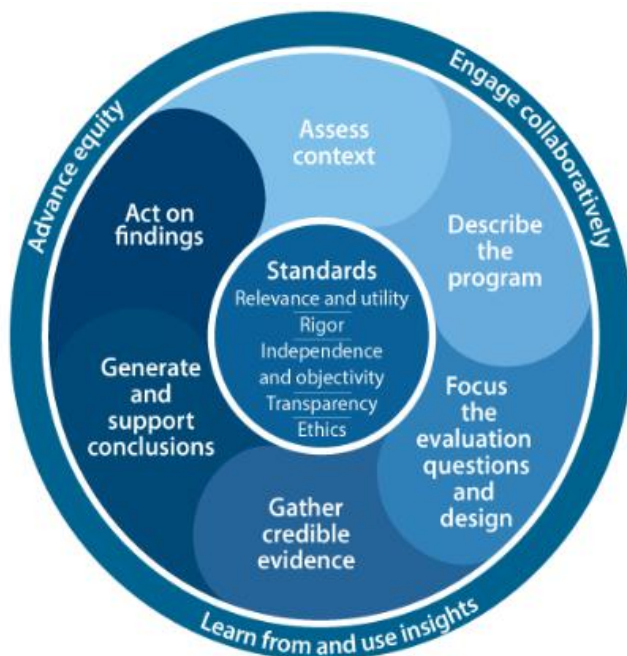


Figure 2: Centers for Disease Control and Prevention. (2024, August 20). *CDC Program Evaluation Framework*. Centers for Disease Control and Prevention. <https://www.cdc.gov/evaluation/php/evaluation-framework/index.html>

Cross-Cutting Actions

These three essential cross-cutting actions are the foundational principles in the evaluation process. These steps ensure rigorous, inclusive, and actionable evidence that supports informed decision-making and promotes health equity (CDC, 2024). The three cross-cutting actions are to engage collaboratively, advance equity, and learn from and use insights.

Engage Collaboratively

Evaluators can enhance the validity of evaluation findings and increase their use by fostering co-ownership with interest holders, starting from the planning phase and continuing through implementation and interpretation (CDC, 2024).

Advance Equity

Health equity ensures everyone has a fair opportunity to achieve their highest health levels, and evaluators can promote it by using collaborative, equitable approaches, considering equity impacts in every step, being culturally responsive, and uncovering factors that perpetuate health inequities (CDC, 2024).

Learn From and Use Insights

Evaluators facilitate continuous learning and improvement by building relationships, cultivating trust, and demonstrating the value of evaluation findings to stakeholders (CDC, 2024).

These three cross-cutting actions partner and build onto the CDC's PEF to ensure a thorough program evaluation.

Five Evaluation Standards

In addition to cross-cutting actions, the five evaluation standards for quality evaluation used to lead outcomes at each step include: 1. Relevance and Utility, 2. Rigor 3. Independence and Objectivity 4. Transparency 5. Ethics.

Relevance and Utility

Evaluations should provide actionable, timely, and relevant information that aligns with stakeholders' interests and is presented in an understandable, culturally responsive, and informative manner (CDC, 2024).

Rigor

Evaluations should yield reliable findings for stakeholders, accompanied by clear explanations of limitations. Careful planning, design, and methods should determine their rigor and accurately interpret and report results (CDC, 2024).

Independence and Objectivity

Evaluations should aim for independence and objectivity to ensure acceptance of findings by stakeholders, experts, and the public; they should be protected from political or other external influences that may compromise their impartiality and professional judgment (CDC, 2024).

Transparency

Evaluations must maintain transparency during planning, implementation, and reporting to ensure accountability and prevent manipulation of findings. Key decisions, including the evaluation's purpose, stakeholder access, design, methods, and timeline for releasing findings, should be documented prior to conducting the evaluation (CDC, 2024).

Ethics

Evaluations should adhere to the highest ethical standards to maintain trust, ensuring they are equitable, fair, and just, while considering cultural and contextual factors that may influence the findings or their application (CDC, 2024).

The five evaluation standards serve as foundational principles that guide and align with the CDC's PEF, providing the ethical and methodological basis upon which the six evaluation steps are implemented to ensure a comprehensive and effective evaluation process.

Six Evaluation Steps

Implementing a structured evaluation process is essential for assessing the effectiveness of public health programs. The CDC's six-step PEF provides a systematic approach to ensuring meaningful, data-driven improvements (CDC, 2024).

Step 1: Assess the Context

Understanding a program's context is essential for conducting meaningful and culturally responsive evaluations (CDC, 2024). This involves assessing readiness for evaluation, identifying key stakeholders, considering place-based factors such as community history and power dynamics, and evaluating individual and organizational evaluation capacity. Key steps include conducting an evaluability assessment, mapping interest holders, documenting contextual factors, and ensuring the program has the necessary resources and structure to support a successful evaluation (CDC, 2024).

Step 2: Describe the Program

Step two involves clearly describing the program by identifying its intended outcomes and key activities, forming the foundation for a successful evaluation. This includes developing a

logic model—a visual roadmap linking activities to outcomes—and a narrative that details the program’s needs, inputs, activities, outcomes, contextual factors, and stage of development.

Understanding these elements ensures alignment between evaluation efforts and the program’s current phase, facilitating accurate assessment and meaningful improvements (CDC, 2024).

Step 3: Focus the Evaluation Question and Design

Step three focuses on the evaluation by engaging stakeholders, refining key questions, and selecting an appropriate design. It involves defining the evaluation’s purpose, identifying intended users and uses, and determining its formative, process, outcome, impact, or economic. The evaluation design, whether experimental, quasi-experimental, or observational, is chosen based on the program’s context, available resources, and scientific rigor needed to answer key questions effectively (CDC, 2024).

Step 4: Gather Credible Evidence

Gather Credible Evidence focuses on identifying the evidence needed to answer evaluation questions, developing a data collection strategy, and selecting appropriate methods for data gathering. Evaluators must collaborate with stakeholders to establish realistic expectations, choose between qualitative and quantitative methods (or a mixed approach), and ensure data quality through accuracy, completeness, consistency, timeliness, and relevance (CDC, 2024). This step also involves identifying indicators, selecting data sources, and implementing data collection instruments while considering ethical and cultural factors.

Step 5: Generate and Support Conclusions

Step five focuses on generating evaluation conclusions by analyzing and interpreting data collected in step four. This involves engaging stakeholders, planning and conducting quantitative

and qualitative data analysis, and collaboratively interpreting findings to ensure meaningful and actionable insights (CDC, 2024). The last step is developing clear, evidence-based recommendations that align with stakeholder expectations, prioritize feasible actions, and establish a follow-up process to track progress.

Step 6: Act on Findings

The final step focuses on translating evaluation findings into actionable decisions by engaging stakeholders in planning, communicating, and applying insights. This involves identifying the audience, communicating the findings, and integrating the results into decision-making (CDC, 2024). Evaluators play a key role in facilitating this process, supporting stakeholders in interpreting and acting on the findings while preventing misuse.

Purpose

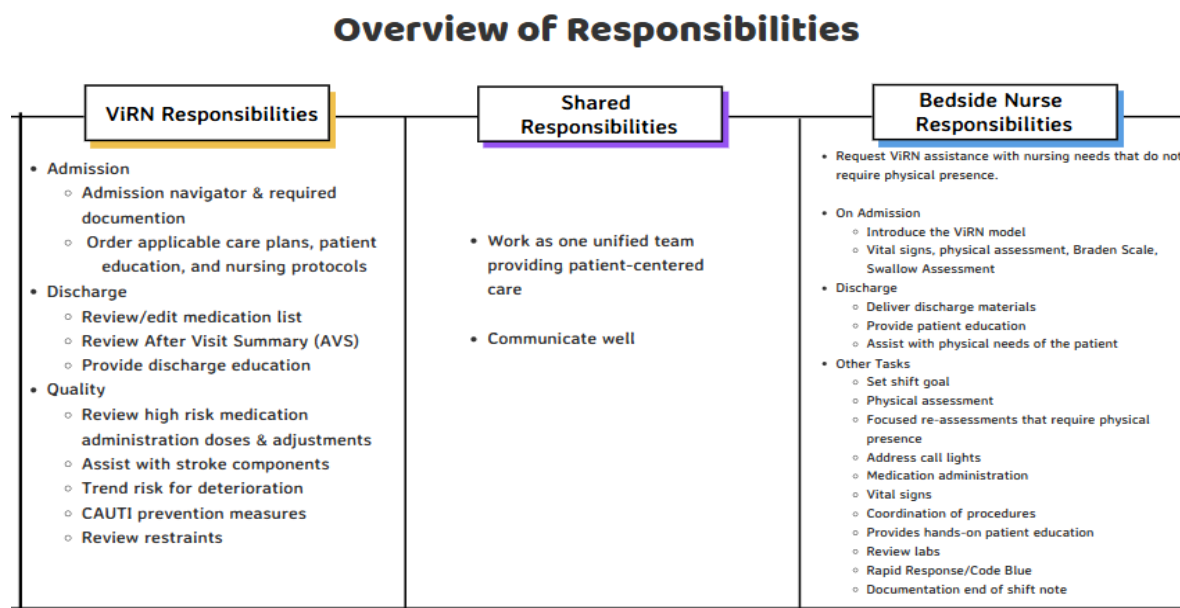
This program was implemented at one health system hub site on May 18, 2022, rolled out through June 27, 2022, and continued to operate thereafter. The purpose of this project was to complete a program evaluation of the ViRN program at this hub site, using the following criteria: the adoption process for admissions and discharges, the quality of Heparin administration, nurse satisfaction, and overall program utilization. The evaluation aimed to determine the effectiveness of the program's adoption process, including admissions and discharges, and overall utilization within the hub site. Findings provided insights into ViRN's impact on Heparin administration, bedside RN workflow partnerships, and overall nurse satisfaction with the ViRN. The results identified areas for improvement, supported evidence-based decision-making for program refinement, and justified potential expansion throughout the academic medical center's Enterprise.

Methods

The purpose of this project was to complete a program evaluation of the ViRN program on one health system hub site, using the following criteria: the adoption process of admission and discharge, the quality of Heparin administration, nurse satisfaction, and the overall adoption process. This hub site consisted of three medical/surgical units, totaling 72 beds. Figure 3 illustrates the work of the ViRN, the bedside nurse, and their shared responsibilities related to admissions, discharges, and quality work.

Figure 3

Overview of Responsibilities



The program evaluation focused on four key metrics that had been previously established and utilized by the Academic medical center's enterprise and the health system during the implementation of the ViRN program. These metrics were selected to ensure consistency with organizational standards and to enable meaningful comparison across similar implementation sites.

Data collection was conducted as part of a student-led project. All required Institutional Review Board (IRB) training and documentation have been completed to ensure adherence to ethical research standards and to protect participants' rights and confidentiality. All data were evaluated and de-identified, and a comprehensive analysis of the data was conducted.

Objective 1: To Evaluate the Adoption Process of ViRN for Completing Patient Admissions and Discharges

A survey by Ransford et al. (2024) found that 77% of nurses spent over three hours per shift on admissions, discharges, and patient education, increasing workloads and limiting direct patient care. The academic medical center enterprise had established a standard ViRN process for managing approximately 90% of admissions and discharges, reflecting its commitment to enhancing operational efficiency and supporting optimized nursing workflows across all implemented sites. Delays in patient discharge had significantly impacted patient throughput due to staffing and workload challenges (Perpetua et al., 2023). By leveraging ViRN technology, the academic medical center hospitals and health system sites streamlined patient transitions, reduced the burden on bedside nurses, and improved care coordination. ViRN performed all admission- and discharge-related tasks that did not require physical presence at the bedside, including managing the Electronic Health Record (EHR) admission navigator, initiating patient education, developing the care plan, and ordering protocols; see Figure 4 for EHR Admission Navigator required items within four and 24 hours of admission. Typically, the only components requiring bedside nurse involvement during admission included aspiration screening (due to the need for the patient to drink water), height and weight measurements, vital signs, and trauma or abuse screenings.

Figure 4*EHR Admission Navigator***Requirements of Admission**

Required within 4 Hours of Admission	Required within 24 Hours of Admission
<ul style="list-style-type: none"> • Admission Notifications • Allergies Reviewed • Aspiration Risk Screening • Delirium Screening • Drug Screening • Pain Assessment • Review Prior to Admission Medications • Travel and Exposure Screening • Vitals, Height, and Weight 	<ul style="list-style-type: none"> • ADL Assessment • ADL Device Assessment • Advance Directive Assessment • Cultural Practice • Designation of Care • Discharge Planning Assessment • Early Screen for Discharge Planning • Fall Assessment • History Reviewed • Interpreter Services • LDAs, Implants, & Medical Devices • Nutrition Assessment • Social Determinates of Health (SDOH) • Smoking History Documents • Tablet Status • Trauma/Abuse Assessment

ViRN played a crucial role in patient education and medication management. ViRN is responsible for reviewing the After Visit Summary (AVS), a key component of patient education, and entering medication details, which had previously been completed manually before automation. Additionally, it provided handoff reports to post-acute care facilities, when needed, to assist with patient transitions.

To support Objective 1, which evaluated the ViRN adoption process for completing patient admissions and discharges, EHR reports assessed ViRN utilization from May 1, 2023, to May 31, 2025. As a student, data were extracted and de-identified directly from the EHR in accordance with institutional guidelines. Appendix B1 provided a departmental breakdown of ViRN-assisted admissions, while Appendix B2 outlined discharges supported by ViRN staff. These data offered meaningful insights into the implementation and integration of the ViRN

process within inpatient workflows. Data were analyzed by comparing them to the enterprise standards, with the data entered in Appendix B1 and B2 graphs and the original data discarded.

Objective 2: To Evaluate the Impact of the ViRN Program on Medication Safety

Heparin was identified as a medication that could have serious hemorrhagic effects if administered improperly (Harder et al., 2005). ViRN enhanced patient safety by serving as a second witness and visual verification for Heparin administration, ensuring accurate dosing and protocol adherence. The "second set of eyes" reinforced the on-site nurse's assessments and ensured consistent evidence-based care, thereby promoting team confidence (Boston-Fleischhauer, 2017).

The ViRN program was designed to reduce the frequency of Heparin administration errors and near misses, commonly referred to as "good catches." This was achieved through a process that supported quality work by reducing errors and aligning with the academic medical center enterprise's goal of enhancing medication safety. The ViRN automatically initiated an EHR task for the bedside nurse upon new patient admission to ensure appropriate adjustments to the heparin protocol and the timely ordering of required laboratory tests. This process actively monitored dosage changes and lab results throughout the course of treatment, thereby enhancing protocol adherence, minimizing the risk of medication errors, and supporting compliance with hospital standards.

Safety Event Reports, which tracked trends in dosing discrepancies, missed lab checks, and adherence to protocols, measured ViRN's effectiveness in reducing Heparin errors. The Patient Safety Report tool was used to analyze heparin Safety Events from January 1, 2023, through December 31, 2024, as shown in Appendix C1. Due to a system switch in July 2022,

pre-implementation data were analyzed using heparin Safety Events documented via the Event System (May 1, 2020–May 1, 2022), as noted in Appendix C2. Although the reporting systems operated on different platforms, both contained the requisite data to capture safety events related to heparin administration, allowing for equivalent data analysis. Analyzing these reports enabled hospitals to evaluate the ViRN process for medication safety, identify opportunities to optimize processes, and ultimately improve patient outcomes.

To support Objective 2, which evaluated the impact of the ViRN program on medication safety, the Patient Safety Department extracted and de-identified all relevant patient and unit-level data from both reporting systems for designated periods for analysis.

Objective 3: Evaluate Nurse Satisfaction with the ViRN

In acute care environments, the integration of virtual nursing demonstrated significant potential in reducing cognitive and physical burden among bedside nurses by redistributing non-urgent clinical tasks, such as discharge teaching and documentation, to off-site virtual RNs (Savitz et al., 2023). This collaborative approach enabled nurses to concentrate on high-value, patient-facing care activities while enhancing overall workflow efficiency. Virtual nursing also fostered real-time communication between team members, minimizing task fragmentation and interruptions that commonly contributed to nurse dissatisfaction and burnout (DiCello et al., 2024). Nurse satisfaction levels were measured through a survey that assessed perceptions of workflow, communication, and overall support provided by the ViRN. By evaluating nursing satisfaction post-implementation, health systems assessed whether the ViRN contributed to improved team coordination, reduced task overload, and greater job satisfaction.

Research Electronic Data Capture (REDCap) was used as a secure, web-based platform that facilitated research data collection through a validated, user-friendly interface and maintained audit trails to ensure data integrity and transparency (Harris et al., 2009). An electronic survey tool using a Likert scale and open-ended questions was created and deployed via REDCap to assess willingness to use, accessibility of the ViRN nurse, perceived value, time reduction, ease of use, and comfort using the platform; see Appendix E: Virtual Registered Nurse (ViRN) Satisfaction Survey – Bedside Nurse Feedback.

To support Objective 3, which evaluated nurse satisfaction with the ViRN, RNs on the three selected inpatient units at the hub site received an email invitation (Appendix D) from the Administrative Assistant (AA), which included a secure link to the Virtual Registered Nurse (ViRN) Satisfaction Survey – Bedside Nurse Feedback (Appendix E). Participation was anonymous, confidential, and entirely voluntary, with the option to withdraw at any time without penalty. To encourage participation, the DNP student attended daily 0700 huddles during the first week of survey distribution and weekly thereafter. Additional reminders were provided through weekly email messages and unit newsletters (Appendix F). The AA collected and de-identified all survey responses to ensure confidentiality before forwarding the aggregated results for analysis.

The survey collected demographic data including nurses' age, years of experience, and the shift during which they completed the survey. These domains reflected standard metrics in evaluating health technology acceptance and usability (Ransford et al., 2024). Administered during a focused 4-week data collection period from June 9, 2025, through July 6, 2025, the survey targeted medical/surgical nurses within the three units at the project's focus health system

hub site who adopted ViRN following the 2022 rollout. Analysis examined satisfaction patterns and usage to identify areas needing improvement and overall implementation. Understanding nursing perspectives was essential to guide the ongoing refinement and expansion of nursing services, particularly as organizations sought to enhance nurse retention, improve care delivery, and adapt to workforce challenges (Kurtović et al., 2024).

Objective 4: Evaluate the Overall Integration of the ViRN Process into Existing Inpatient Workflows

Collaboration in patient care and care environment monitoring was essential to the success of virtual care models, with staff-level engagement and shared decision-making serving as key pillars (Gregory, 2023). By leveraging ViRN technology, the academic medical center hospitals streamlined patient transitions, reduced the burden on bedside nurses, and improved care coordination (DiCello et al., 2024).

To support Objective 4, which evaluated the integration of the ViRN process into existing inpatient workflows, overall ViRN utilization at the hub site was assessed using monthly averages across three units. Data was collected from July 1, 2022, through April 30, 2025, as detailed in Appendix G. The ViRN Nurse Manager provided unit-level data, which were de-identified prior to extraction and analysis to maintain confidentiality.

Evaluation Measures

The ViRN program evaluation focused on four key objectives. First, adoption was assessed by examining utilization rates of ViRN-assisted admissions and discharges. Second, heparin medication safety was evaluated by analyzing the frequency and nature of heparin-related safety events before and after ViRN implementation. Third, nurse satisfaction was

measured through the perceptions of bedside registered nurses regarding ViRN's impact on workflow, communication, and overall support, as assessed via a survey. Finally, workflow integration was assessed to determine the extent to which ViRN was successfully incorporated into inpatient unit activities.

Analysis

The evaluation of the intervention used both qualitative and quantitative measures to analyze the program evaluation objectives. The sources of quantitative data included reports from electronic health records (EHRs), safety event records, and the response rates to surveys. Descriptive statistics were utilized to analyze ViRN adoption rates and nurses' satisfaction evaluation scores. Qualitative data, such as the open-ended survey responses, were collected. Thematic analysis was conducted to identify recurring challenges and perceived benefits associated with ViRN. A comparative review was conducted to assess the level of safety before and after implementation of the ViRN, to determine the impact of the ViRN program on medication safety.

Ethical Considerations

All data were de-identified to protect the confidentiality of patients and staff. Participation in the nurse satisfaction survey was voluntary, anonymous, and included informed consent. Ethical principles, including transparency, equity, and respect for participants, were consistently upheld throughout the evaluation process.

IRB Review and Approval

Data collection for this student-led project was conducted after completion of all required Institutional Review Board (IRB) training and documentation, ensuring adherence to ethical

standards and participant confidentiality. All data were de-identified before comprehensive analysis (see Appendix H: University of Arizona IRB).

Results

Objective 1: To Evaluate the Adoption Process of ViRN for Completing Patient Admissions and Discharges

To assess the effectiveness of the ViRN adoption process in supporting inpatient workflows, EHR utilization data from May 1, 2023, to May 31, 2025, was analyzed. The data reflects integration of the ViRN role in managing components of admissions and discharges across three inpatient units within the academic medical center (Table 1).

Table 1

ViRN Assisted Admissions

ViRN Assisted Admissions by Department 1, 2023, to May 31, 2025

Unit	Number of Admits	ViRN Assisted Admissions	% ViRN Assisted Admissions
1	3,985	2,257	56.6%
2	3,270	2,343	71.7%
3	4,518	2,780	61.5%
Total	11,773	7,380	62.7%

During this period, ViRNs assisted with 7,380 out of 11,773 total admissions, achieving an average adoption rate of 62.7%, with unit-level rates ranging from 56.6% to 71.7%, noted in Table 1. The effective integration of ViRN into the admission process reflects substantial advancement in the adoption of ViRN-enabled workflows, supporting broader initiatives to enhance nursing efficiency and decrease administrative workload.

The utilization of ViRNs in discharge processes remains relatively low, with 2,999 of 12,991 discharges (23.1%) supported by ViRNs (Table 2).

Table 2*Discharge Assists by ViRNs by Department – Summary Report***Discharge Assists by ViRNs by Department – Summary Report (May 1, 2023-May 31, 2025)**

Unit	Number of Discharges	ViRN Assisted Discharges	% ViRN Assisted Discharges
1	4,596	656	14.3%
2	3,667	1,167	31.8%
3	4,728	1,176	24.9%
Total	12,991	2,999	23.1%

Unit-specific discharge support rates ranged from 14.3% to 31.8%, indicating variability in workflow integration and highlighting opportunities for targeted improvement. Given that delays in discharge can adversely affect overall hospital patient throughput and increase the workload for bedside nurses (Perpetua et al., 2023), enhancing ViRN discharge participation is a key opportunity to alleviate nursing workload further and streamline care transitions. These findings not only support continued evaluation and refinement of ViRN implementation strategies but also highlight the potential for significant growth in ViRN's impact on both admission and discharge processes.

Objective 2: To Evaluate the Impact of the ViRN Program on Medication Safety

The ViRN program had a significant impact on medication safety. Following its implementation, evident improvements were observed in heparin medication safety, including enhanced adherence to protocols, timely laboratory monitoring, and improved interdisciplinary communication. Before ViRN, safety events from May 2020 to May 2022 revealed recurring issues, indicating system-level gaps in medication reconciliation and communication (Table 3).

Table 3*Event System-Heparin Safety Events***Event System-Heparin Safety Events (May 1, 2020-May 1, 2022)**

Event Class	Event Type	Significance	Abstract Cc
Management of care events (MGT)	MGT-Anticoagulation Related	C - Reached-did not cause harm	The patient was inadvertently prescribed both rivaroxaban and enoxaparin for anticoagulation; the duplication was identified by the pharmacist the following morning, enoxaparin was discontinued, and the provider was notified with a recommendation for close bleeding monitoring.
Medication & IV events (MED)	MED-Wrong dose or quantity	C - Reached-did not cause harm	A patient on a high-intensity heparin drip for a new pulmonary embolism had a slightly low FXa level in the morning, but the heparin dose was not adjusted because the nurse misinterpreted. Pharmacy identified the issue, the repeat FXa level was within range, no dose adjustment was needed, and no harm occurred.
Management of care events (MGT)	MGT-Anticoagulation Related	C - Reached-did not cause harm	A patient received concurrent orders for enoxaparin and a heparin infusion from the same provider, both verified by the same pharmacist. The patient received one dose of SQ enoxaparin while the heparin infusion was running, and the incident was noted for follow-up with the new nurse involved
Management of care events (MGT)	MGT-Anticoagulation Related	C - Reached-did not cause harm	During handoff from the patient's GI procedure, the RN stated the patient should not receive any anticoagulation for 24 hours. Later in the shift the patient was administered his bedtime dose of subcutaneous heparin. Epic orders didn't get updated to reflect holding anticoagulation.
Management of care events (MGT)	MGT-Anticoagulation Related	C - Reached-did not cause harm	Heparin drip started 9/3/2020 at approx 17:30. Hep Xa lab was ordered for 23:30 on 9/4/2020 instead of 9/3/2020.

The introduction of ViRN provided a second layer of verification by monitoring EHR, identifying errors in real-time, and communicating with clinical teams to ensure that corrective actions were taken, improving patient safety but also increasing the efficiency of the healthcare system.

Post-implementation safety data from January 2023 through December 2024 show ViRN's meaningful impact, with multiple 'good catches' documented.

Table 4*Patient Safety System-Heparin Safety Events***Patient Safety System-Heparin Safety Events (January 1, 2023-December 31, 2024)**

EventSubType	HarmLevelFinal	EventDescription
MED-Administration	Category C - Event occurred that reached the patient but did not cause patient harm	Heparin anti-Xa level < 0.1 and RN increased the heparin infusion by 2 units/kg/hr, but should have been increased by 4 units/kg/hr AND a heparin bolus of 60 units/kg should have been given. Discrepancy noticed by ViRN, who notified the pharmacist. Pharmacist moved the heparin anti-Xa level time to reflect new bolus time and increase dose time.
MED-Other	Category D - Event reached patient and required monitoring to confirm no harm or preclude harm	While assessing heparins it was noted that a loading dose of heparin was not noted in the chart for the last result of <0.10. ViRN reached out to the nurses. Bedside nurse notified the service and will continue to monitor.
MED-Administration	Category C - Event occurred that reached the patient but did not cause patient harm	ViRN reviewed recent anti-xa results for heparin drip and noticed that the patient's rate had not increased per MAR calculate based on recent lab results. ViRN reached out to bedside RN to confirm rate had not increased from 12 units/kg/hr to 18 units/kg/hr - bedside RN confirmed rate increase was not noticed and made the rate change.
Lab-Ordering Process	Near Miss - Reach, No Harm	While reviewing heparin orders, ViRN noticed pharmacy did not have aPTT ordered. Stat aPTT was drawn at 22:51.
MED-Other	Category B - Event occurred but did not reach the patient	Upon review of AVS by ViRN, Heparin injections were noted on the discharge medication list. Clarified with provider that patient will not need to continue this at home. Asked provider to update AVS.

These ‘good catches’ are instances where ViRN identified and corrected potential errors, thereby preventing adverse events. They included identifying missed heparin bolus doses, incorrect dosage adjustments based on anti-Xa levels (a blood test that evaluates the efficacy of anticoagulant medications), unplaced follow-up labs, and incorrect discharge prescriptions. The ViRN program served as an electronic safeguard, contributing to medication safety by reducing preventable errors and supporting institutional objectives related to reliability and patient-centered care.

Objective 3: Evaluate Nurse Satisfaction with the ViRN

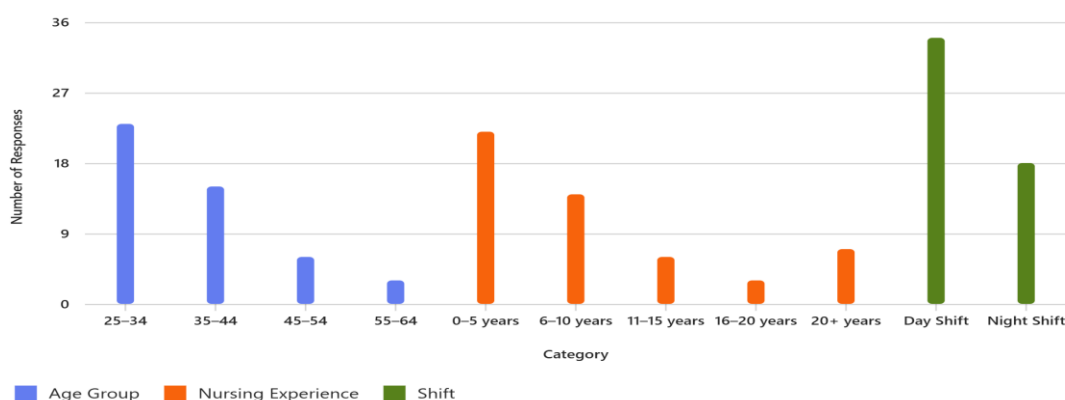
A total of 90 Virtual Registered Nurse (ViRN) Satisfaction Surveys – Bedside Nurse Feedback were distributed across three inpatient units, with 53 bedside registered nurses completing the survey, yielding a 59% response rate.

Section 1: Demographics

Section One of the survey addressed nurse demographics, including age group, years of experience, and current work shift (Figure 5).

Figure 5

Demographic Questions



The demographic survey results indicate that most respondents were aged 25–34 (23 responses), followed by those aged 35–44 (15 responses), with participation decreasing in older age groups and the fewest responses (3) from individuals aged 55–64. In terms of nursing experience, most respondents reported having 0–5 years (22 responses), followed by 6–10 years (14 responses). Only seven respondents had more than 20 years of experience. Regarding the shift during which the survey was completed, most participants (34 responses) participated during the Day Shift, while fewer responses (18) were recorded during the Night Shift.

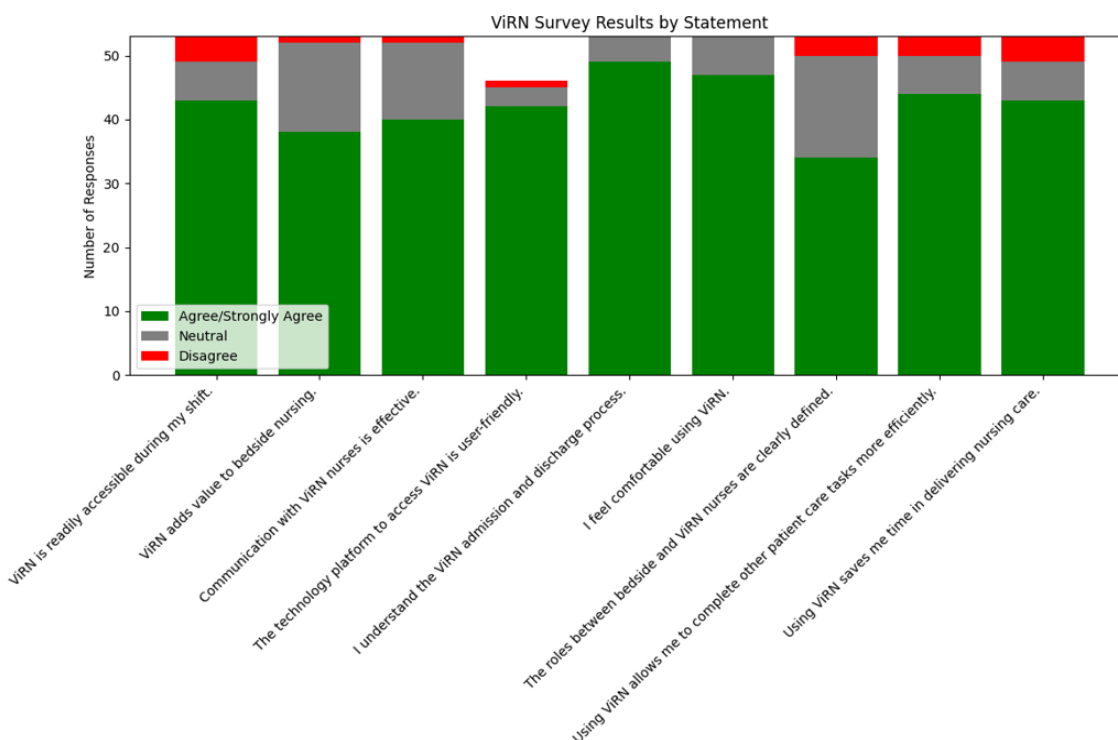
Section 2: Likert Scale Question

ViRN Survey Section Two comprised Likert-scale questions evaluating the accessibility and user-friendliness of ViRN during clinical shifts. The survey addressed the clarity of roles and the effectiveness of communication between bedside and ViRN nurses. Additionally,

respondents assessed ViRN's contribution to enhancing bedside care by improving time management, supporting task efficiency, and facilitating a streamlined and comprehensible process for patient admission and discharge (Figure 6)

Figure 6

Likert Scale ViRN Questions



Across all nine statements, most respondents expressed positive perceptions of ViRN. Most notably, 49 respondents agreed or strongly agreed that they understood the ViRN admission and discharge process, and 47 felt comfortable using ViRN. Statements regarding accessibility, communication, and time-saving benefits also received strong agreement, with minimal disagreement or neutrality. The technology platform was widely regarded as user-friendly, and ViRN was seen as adding value to bedside nursing. This overwhelmingly positive

feedback from the ViRN Satisfaction Surveys is encouraging and suggests a high level of satisfaction and confidence in ViRN's integration into nursing workflows.

While most responses leaned toward agreement, a few areas, such as role clarity between bedside nurse and ViRN, showed slightly more neutral or disagreeing responses, suggesting opportunities for further clarification or support. Overall, the feedback indicates a high level of satisfaction and confidence in ViRN's integration into nursing workflows, as shown in Figure 6.

Section 3: Open-Ended Feedback

Section Three of the ViRN Survey questions centered on gathering open-ended feedback from nursing staff to better understand their experiences with the ViRN program. It included four key questions: what aspects of ViRN work well in their unit, what challenges they have encountered, the value or benefits ViRN provides in their role, and suggestions for improving ViRN integration. This section aims to capture both the strengths and areas for growth from the perspective of frontline users, offering valuable insights to guide future enhancements and support effective implementation.

Question 1: What aspects of ViRN work well in your unit?

Nurses consistently recognize the ViRN as valuable support in completing time-consuming clinical tasks, particularly during patient admissions and discharges. ViRN's support with admission checklists, discharge education, and provider coordination is valued for improving workflow efficiency. Bedside nurses report that ViRN significantly reduces their clinical burden, allowing more time for direct patient care, especially during high-volume periods with multiple admissions or discharges. Feedback highlights the platform's user-friendly

interface, effective communication practices, and the proactive approach demonstrated by ViRN nurses in managing referrals and outreach to providers.

Nurses appreciated delegating tasks like Magnetic Resonance Imaging (MRI) screening, provider reporting, and discharge coordination to the ViRN, which improved time management and team efficiency. Overall, ViRN is considered user-friendly and beneficial for workflow, safe care transitions, and focused nursing bedside presence.

Question 2: What challenges have you experienced using ViRN?

Despite mostly positive feedback, ViRN is less effective with confused or hearing-impaired patients, according to comments such as “ViRN is unsuccessful if the patient is confused or cannot hear” and “not helpful in hard-of-hearing patients.” Regardless of the many benefits of the ViRN program, several limitations and challenges have been consistently identified by frontline nurses. The most frequently reported concern involves delayed response times, particularly during peak hours or when ViRN nurses are on break, which hinders the timely completion of admissions and discharges. These delays often result in patient dissatisfaction, with some patients declining to interact with ViRN due to frustration or a preference for in-person care. Additionally, inconsistent availability, such as ViRN staff covering multiple units or being difficult to reach, contributes to workflow disruptions and increased workload for bedside staff. Technology barriers, including audio/visual issues and the ineffectiveness of the system for patients with hearing loss or confusion, further limit ViRN's usefulness in specific scenarios. Despite mostly positive feedback, ViRN is less effective with confused or hearing-impaired patients, according to comments such as “ViRN is unsuccessful if the patient is confused or cannot hear” and “not helpful in hard-of-hearing patients.”

Other noted concerns include inconsistencies in the scope and performance of ViRN nurses, such as incomplete admission components (e.g., medication reconciliation), as well as variability in communication and critical thinking skills. Some bedside nurses express discomfort with delegating discharge teaching due to concerns about the quality of care or professional accountability. Visible pets and background noise in ViRN personal environments were sometimes noted as concerns. Communication gaps regarding waiting times or task completion status can create uncertainty and inefficiency. These issues suggest a need for more specific role definitions, enhanced training, and improved communication protocols to ensure that ViRN integration consistently meets the professional expectations of both staff and patients.

Question 3: In your experience, what value or benefits does the Virtual RN (ViRN) program provide to you in your role?

The ViRN program has demonstrated significant benefits in enhancing nursing efficiency and improving patient care workflows. One of the most frequently cited advantages is the time savings it provides by taking over clinical tasks such as admissions, discharges, medication reconciliation, and patient education. This delegation allows bedside nurses to focus on direct patient care and hands-on responsibilities, which are particularly beneficial during high-acuity situations or staffing shortages. ViRN's ability to streamline administrative tasks contributes to reduced stress, improved time management, and greater nursing satisfaction.

ViRN plays a crucial role in maintaining patient flow and operational efficiency, particularly in fast-paced environments such as emergency departments and high-turnover units. Nurses report via the survey response that the consistency and thoroughness of ViRN-facilitated admission interviews and discharge education enhance patient understanding and safety during

admission and discharge process. ViRN, in general, positively influences clinical workflow and nurse burden, as well as patient satisfaction and continuity of care noted throughout the survey.

Question 4: What improvements would you suggest for ViRN integration?

Feedback from bedside nurses highlighted several opportunities to enhance the effectiveness and integration of the ViRN program. Many nurses suggested expanding ViRN responsibilities to include a broader range of clinical tasks, such as completing full admission checklists, reassessments, medication lists, and discharge documentation across all shifts. Improved discharge processes were also emphasized, including structured handoffs and the addition of discharge summaries. Nurses expressed a strong desire for more transparent and timely communication from ViRN nurses, such as estimated wait times, task progress updates, and availability information, via group chats or status boards, to reduce uncertainty and improve workflow coordination. Additionally, increased ViRN staffing, particularly during high-volume periods or within large units, was identified as a key need to minimize delays and improve response times.

Additional recommendations involved standardizing ViRN assignments by unit or shift to enhance continuity and familiarity among patients and nursing staff, thereby facilitating improved communication and throughput. Furthermore, the use of a tip sheet summarizing ViRN capabilities and scope was suggested to support staff awareness and effectiveness. Technological improvements, such as Bluetooth hearing impaired headphones for patients with hearing difficulties, were also proposed to enhance the patient experience. Feedback from nurses reflects appreciation for the value ViRNs bring to workflow efficiency and patient satisfaction. However, a few experienced nurses expressed skepticism, preferring to complete tasks themselves due to

concerns about speed or personal connection. Overall, nurses recognized ViRN as a valuable innovation with the potential for even greater impact through expanded task support, communication enhancements, and consistent role awareness.

Objective 4: Evaluate the Overall Integration of the ViRN Process into Existing Inpatient Workflows

To evaluate the extent of ViRN integration, utilization data were collected from July 1, 2022, through April 30, 2025, across three inpatient units. Table 5 summarizes the total number of opportunities for ViRN use, the completed occurrences, and corresponding utilization percentages by unit.

Table 5

Overall ViRN Integration

Overall ViRN Usage (July 1, 2022–April 30, 2025)

Unit	Total Number of Possibilities	Completed Possibilities	Percentage
1	8,581	2,913	33.9%
2	6,937	3,510	50.6%
3	9,246	3,956	42.8%
Total	24,764	10,379	41.9%

The accumulated utilization rate of 41.9% indicates moderate adoption of the ViRN process in daily clinical workflows, with unit-level variation ranging from 33.9% to 50.6%. Unit 2 demonstrated the highest integration, surpassing 50% of possible ViRN engagements, suggesting greater workflow incorporation or staff familiarity. Inversely, Unit 1's lower utilization at 33.9% may reflect workflow barriers or opportunities for targeted engagement strategies.

These findings reflect early to moderate integration of ViRN technology within inpatient workflows. Sustained staff engagement and leadership support are crucial for increasing virtual care adoption (Sakumoto et al., 2024). Ongoing monitoring of utilization trends and qualitative assessments of staff perceptions will further inform optimization efforts to fully embed ViRN processes, thereby enhancing patient transitions and nursing workload distribution.

Discussion

Alignment with DNP Essentials

The evaluation of the ViRN program demonstrates alignment with the DNP Essentials (AACN, 2006) through its integration of scientific inquiry, leadership, and evidence-based practice. Guided by the CDC Program Evaluation Framework, the project reflects Essential I: Scientific Underpinnings for Practice by applying structured inquiry to advance nursing knowledge (AACN, 2006). Essential II: Organizational and Systems Leadership is evident by evaluating the effects of program implementation across multiple inpatient units, resulting in improved workflow efficiency, medication safety, and nurse satisfaction (AACN, 2006). Through quantitative and qualitative analysis of electronic health record data, safety reports, and nurse satisfaction surveys, the evaluation fulfills Essential III: Clinical Scholarship and Analytical Methods for Evidence-Based Practice by generating actionable insights for practice improvement (AACN, 2006).

The program evaluation reflects Essential IV: Information Systems/Technology and Patient Care Technology by evaluating the effectiveness of embedding virtual care into clinical workflows to enhance communication and reduce burden on bedside staff (AACN, 2006). This evaluation demonstrated collaboration among ViRN nurses, unit staff, and pharmacists as

outlined in Essential VI: Interprofessional Collaboration, while identified improvements in discharge planning and transitions of care align with Essential VII: Clinical Prevention and Population Health. Finally, the evaluation of the program highlights Essential VIII: Advanced Nursing Practice as DNP-prepared nurses lead the design, implementation, and evaluation of an innovative care model, thereby advancing safe, effective, and sustainable healthcare delivery (AACN, 2006).

Sustainability

The program is designed with a hybrid staffing model where ViRN nurses maintain clinical competency by working 50% of their full-time equivalent (FTE) on inpatient floors and the remaining 50% in virtual roles, ensuring ongoing relevance and adaptability. The program's integration into existing workflows, demonstrated by increasing utilization rates across units, reflects growing acceptance and operational alignment. Additionally, the program's alignment with institutional goals for high reliability, patient-centered care, and medication safety (e.g., adherence to the heparin protocol) further reinforces its long-term viability. Feedback from bedside nurses also highlights ViRN's value in reducing clinical burden and improving workflow efficiency, suggesting strong frontline support for continued use and expansion. These factors collectively indicate that the ViRN model is scalable and is positioned for impact within medical/surgical inpatient care settings.

Limitations

This project's evaluation of the ViRN program faced several limitations. The 59% response rate (53 of 90) may introduce response bias, as participants who chose to participate may be more engaged or have stronger opinions about ViRN, potentially limiting the findings.

The respondent pool was predominantly composed of nurses aged 25–34 with 0–5 years of experience, and most completed the survey during day shifts. This demographic data skew may have excluded perspectives from more experienced staff and night shift nurses. Additionally, the evaluation was conducted at a single site, which limits the broader pertinence of the results. The project depended on self-reported data, which may be influenced by individual perceptions and feelings. Finally, the safety event data may have been affected by inconsistencies during the system transition from one platform to another, and it relies on staffing to report safety events.

Conclusion

The evaluation of the ViRN program revealed meaningful improvements in nursing workflow efficiency, medication safety, and patient care transitions in the units selected for participation. ViRN's integration into inpatient workflows has been positively received by bedside nurses, with high satisfaction scores and consistent feedback highlighting its value in reducing clinical burden and enhancing time management (Garcia-Dia, 2025). The program demonstrated moderate to high adoption rates for admissions and growing engagement in discharge processes, though variability across units suggests opportunities for targeted optimization. ViRN's role in identifying medication errors and supporting protocol adherence further reinforces its contribution to patient safety and institutional goals for high reliability and quality care.

Implications for Future Practice

To maintain and support the ViRN program, several strategic actions are proposed. A formal cost/benefit analysis should be conducted to quantify its financial and operational impact. Increasing utilization, especially for discharges, will benefit from proactive scheduling,

individualized staff engagement, and consistent communication through weekly newsletters to bedside nurses. Establishing partnerships with Quality and Safety teams can enhance alignment with institutional improvement initiatives, thereby increasing medication and patient safety. Virtual nursing care combined with artificial intelligence (AI) enhances efficiency, addresses staffing challenges, and improves patient satisfaction and engagement while preserving the empathy central to nursing (American Nurses Association [ANA], 2025). Exploring the integration of AI may further streamline documentation and monitoring tasks, thereby extending ViRN's capabilities. In addition, the ViRN could streamline workflow by assigning tasks through Epic's brain activity, reducing call button use and unnecessary trips while providing the bedside nurse with a clear timeline of patient orders, events, and duties (EPIC, 2025). These improvements are designed to support the ongoing advancement of ViRN as a scalable and effective model for virtual nursing care, strengthening collaboration with bedside nurses.

Funding

No external or internal funding was received or utilized in the development, implementation, or evaluation of this program.

Appendix A

Evidence Table

Project: Program Evaluation of ViRN Integration: Assessing Teamwork, Adoption, and Quality Outcomes in Inpatient Care

Citation Information	Title of Document or Instrument	Type of Evidence	Main Outcomes of Findings	Relevance to Project
Ransford, J., Tidwell, T., Johnson, L., Gitney, N., Morgan, A., & Hauch, R. (2024). Implementing a virtual discharge nurse pilot. <i>JONA: The Journal of Nursing Administration</i> , 54(11), 605–611. https://doi.org/10.1097/nna.0000000000001498 (Ransford et al., 2024)	Implementing a Virtual Discharge Nurse Pilot	Quality Improvement	Increased nursing job satisfaction, reduced turnover (5.6% decrease), improved patient satisfaction, and reduced adverse safety events. VN completed 81% of unit discharges.	Virtual nursing reduces clinical tasks and increases nursing retention rates while delivering enhanced patient care.
DiCello, D., Evans, R., Ferguson, S., Garcia-Dia, M. J., Manzano, W., Lou Prado-Inzerillo, M., & Radosta, M. (2024). Virtual nursing is used to improve patient and team member experiences at New York-Presbyterian Hospital. <i>NEJM Catalyst</i> , 5(10). https://doi.org/10.1056/cat.23.0313 (DiCello et al., 2024)	Virtual Nursing to Improve Patient and Team Member Experiences at New York-Presbyterian Hospital	Quality Improvement	Improved patient experience scores, reduced burnout, expanded to 11 units, facilitated 30% of discharges, and increased HCAHPS scores.	ViRN strengthens patient communication, discharges, and staff satisfaction rates.
Gregory, D. D. (2023). Virtual nursing: A new care delivery model. <i>HERD: Health Environments Research & Design Journal</i> , 17(1), 30–33. https://doi.org/10.1177/19375867231212671 (Gregory, 2023)	Virtual Nursing: A New Care Delivery Model	Expert Opinion	Decreased length of stay, fall reduction, and improved patient satisfaction. Advocate Health expanded from 3 to 15 units.	The need for virtual nursing unit expansion and how patients benefit from monitoring and educational services.
Tibbe, M., Arneson, S., & Welsh, C. (2023). Rise of the virtual nurse. <i>AACN Advanced Critical Care</i> , 34(4), 314–323. https://doi.org/10.4037/aacnacc2023391 (Tibbe et al., 2023)	Rise of the Virtual Nurse	Literature Review	Healthcare is becoming more complex and needs innovation Improved patient care, reduced nurse burnout, and	Supports virtual nursing to address workload issues and clinical tasks.

Citation Information	Title of Document or Instrument	Type of Evidence	Main Outcomes of Findings	Relevance to Project
			enhanced operational efficiency.	
Schuelke, S., Aurit, S., Connot, N., & Denney, S. (2019). Virtual nursing: The new reality in quality care. <i>Nursing Administration Quarterly</i> , 43(4), 322–328. https://doi.org/10.1097/naq.0000000000000376 (Schuelke et al., 2019)	Virtual Nursing: The New Reality in Quality Care	Program Evaluation	Enhanced patient satisfaction, staff mentoring, quality, and discharge efficiency. Positive effects on financial and quality metrics	Supports ViRN by demonstrating how virtual nursing can enhance quality, ensuring safety, and efficiency.
Ross, J. (2024). Visioning a future: Virtual nursing care. <i>Journal of PeriAnesthesia Nursing</i> , 39(2), 322–323. https://doi.org/10.1016/j.jopan.2024.01.016 (Ross, 2024)	Visioning a Future: Virtual Nursing Care	Literature Review	Virtual nursing improves patient outcomes, nursing satisfaction, and operational efficiency.	The ongoing evaluation and innovative improvements in virtual nursing promote opportunities.
Roberson, A. E., Carlson, M., Kohler, C. M., Harris, P. A., & Volkmann, C. L. (2023a). Initiating virtual nursing in general inpatient care. <i>AJN, American Journal of Nursing</i> , 123(6), 48–54. https://doi.org/10.1097/01.naj.0000938736.42266.5e (Roberson et al., 2023)	Initiating Virtual Nursing in General Inpatient Care	Program Evaluation	Bedside RNs valued ViRN support for clinical guidance and assistance with best practices. Improved patient care.	ViRN supports bedside nursing tasks, which align with and support nurses' needs for usage.
Boston-Fleischhauer, C. (2017). The explosion of virtual nursing care. <i>JONA: The Journal of Nursing Administration</i> , 47(2), 85–87. https://doi.org/10.1097/naa.0000000000000444 (Boston-Fleischhauer, 2017)	The Explosion of Virtual Nursing Care	Expert Opinion	Virtual nursing care improves patient education, reduces nurse burnout, and enhances operational efficiency.	ViRN has been demonstrated as a potential solution to address workforce shortages, improve clinical care quality, and decrease staff burnout.
Schuelke, S., Aurit, S., Connot, N., & Denney, S. (2020). The effect of virtual nursing and missed nursing care. <i>Nursing Administration Quarterly</i> , 44(3), 280–287. https://doi.org/10.1097/naq.0000000000000419 (Schuelke et al., 2020)	The Effect of Virtual Nursing and Missed Nursing Care	Quantitative	No significant changes in missed nursing care pre- and post-implementation of virtual nursing.	Additional research about the impact of virtual nurses (VN) on quality remains necessary.
Boston-Fleischhauer, C. (2024a). Building an evidence-based foundation for virtual nursing. <i>JONA: The</i>	Building an Evidence-Based	Expert Opinion	Virtual nursing can optimize staffing and patient satisfaction, but evidence is	The analysis highlights the importance of data-

Citation Information	Title of Document or Instrument	Type of Evidence	Main Outcomes of Findings	Relevance to Project
<p><i>Journal of Nursing Administration</i>, 54(2), 77–78. https://doi.org/10.1097/nna.0000000000001385 (Boston-Fleischhauer, 2024)</p>	<p>Foundation for Virtual Nursing</p>		<p>needed to identify the most effective models.</p>	<p>based assessments for evaluating virtual nursing practices in hospital environments.</p>
<p>Clipper, B. (2023). Virtual nursing and the impact on safety. <i>Nursing Management</i>, 54(11), 16–21. https://doi.org/10.1097/nmg.000000000000068 (Clipper, 2023)</p>	<p>Virtual Nursing and the Impact on Safety</p>	<p>Expert Opinion</p>	<p>Virtual nursing improves patient outcomes, reduces adverse events, and enhances safety.</p>	<p>ViRN shows benefits for enhancing healthcare safety practices while supporting quality.</p>
<p>Savitz, S. T., Frederick, R. K., Sangaralingham, L. R., Lampman, M. A., Anderson, S. S., Habermann, E. B., & Bell, S. J. (2023). Evaluation of safety and care outcomes after introducing a virtual registered nurse model. <i>Health Services Research</i>, 58(5), 999–1013. https://doi.org/10.1111/1475-6773.14208 (Savitz et al., 2023)</p>	<p>Evaluation of Safety and Care Outcomes After the Introduction of a Virtual Registered Nurse Model</p>	<p>Quantitative Research</p>	<p>ViRN implementation showed similar outcomes to usual care for ICU transfers, mortality, and length of stay.</p>	<p>An objective evaluation of ViRN supports the need for continual model enhancement.</p>
<p>Perpetua, Z., Seitz, S., Schunk, J., Rogers, D., Gala, J., Sherwood, P., Mikulis, A., Santucci, N., Ankney, D., Bryan-Morris, L., & DePasquale, K. (2023). Virtual discharge. <i>Journal of Nursing Care Quality</i>, 38(3), 234–242. https://doi.org/10.1097/ncq.0000000000000689 (Perpetua et al., 2023)</p>	<p>Virtual Discharge: Enhancing and Optimizing Care Efficiency for the Bedside Nurse</p>	<p>Quantitative Pilot Study</p>	<p>Virtual discharge protocols improved patient satisfaction and reduced bedside nurse workload.</p>	<p>ViRN is shown to optimize care efficiency and discharges.</p>
<p>Schwartz, R. L., Hamlin, S. K., Vozzella, G. M., Randle, L. N., Klahn, S., Maris, G. J., & Waterman, A. D. (2024). Utilizing telenursing to supplement acute care nursing in an era of workforce shortages. <i>CIN: Computers, Informatics, Nursing</i>. https://doi.org/10.1097/cin.0000000000001097 (Schwartz et al., 2024)</p>	<p>Utilizing Telenursing to Supplement Acute Care Nursing in an Era of Workforce Shortages</p>	<p>Pilot Study</p>	<p>Virtual nurses successfully managed admissions and discharges, saving bedside nurses time and promoting patient and staff satisfaction.</p>	<p>ViRN creates effective ways to eliminate administrative workloads while increasing workplace efficiency.</p>

Appendix B

Virtual Registered Nurse (ViRN) Admission and Discharge Adoption

B1: ViRN Assisted Admissions by Department-last 7 days (May 1, 2025-May 8, 2025)

Unit	Number of Admits	ViRN Assisted Admissions	% ViRN Assisted Admissions
1	39	20	51.28%
2	41	32	78.05%
3	42	28	66.67%
Total	122	80	65.58%

B2: Discharge Assists by ViRNs by Department - Summary Report-last 7 days (May 1, 2025-May 8, 2025)

Unit	Number of Discharges	ViRN Assisted Discharges	% ViRN Assisted Discharges
1	40	7	17.5%
2	45	20	44.44%
3	42	19	45.24%
Total	127	46	36.22%

Appendix C

Heparin Reports

C1: Patient Safety System-Heparin Safety Events (January 1, 2023- December 31, 2024)

Date Of Event	Event Time	Discovered Date	EventSubType	EventDescription
5/17/2023	12:25	05/17/2023	MED-Other	VIRN cleaning up sign and held orders, canceled the heparin drip order. Rn, and pharmacy notified. Medication re-ordered with no disruption to the patient.
5/18/2023		05/19/2023	MED-Order Process	Duplicate heparin 5000 units SQ q8hr order found on the patient's chart (one was ordered pre-operatively and one was ordered post-operatively). Patient did not receive any duplicate administrations.

C2: Event System-Heparin Safety Events (May 1, 2020-May 1, 2022)

	Event Date	Event Class	Event Type	Significance	Entered By Job Title Name	Abstract Cc
1						
2	5/13/2020	Medication & IV events (MED)	MED-Wrong medication	C - Reached-did not cause harm	PHARMACY TECH II-INPATIENT	A heparin sodium injection (5,000 units/mL) was found among ondansetren injections when a multiple ondansetren injections were being pulled for CNR. It would have been easy to grab the wrong medication.

Appendix D

Recruitment Invitation Email

Subject: Invitation to Participate: ViRN Satisfaction Survey – Bedside Nurse Feedback

Dear Registered Nurses,

You are invited to participate in the **Virtual Registered Nurse (ViRN) Satisfaction Survey – Bedside Nurse Feedback**. This confidential, voluntary, and anonymous survey is designed to gather your insights and experiences related to the ViRN program. Your feedback is vital in guiding improvements and supporting the continued integration of virtual nursing services.

Participation is entirely voluntary, and you may stop the survey at any point without any consequence or impact on your employment. The survey will take approximately 5–10 minutes to complete. All responses are anonymous and will be de-identified before analysis to protect your privacy. If you are willing to participate, please complete by June 27, 2025.

Please click the link below to access the survey:

<https://redcapclin-prod.mayo.edu/redcap/surveys/?s=9HTNCN9KFRT8PRLX>

Please reach out with any questions or concerns.

Thank you for your time and for contributing to the advancement of virtual nursing.

Sincerely,

Joannie Schmidt
University of Arizona
DNP-Executive Health systems Leadership Student
JoannieSchmidt@arizona.edu

Appendix E

Virtual Registered Nurse (ViRN) Satisfaction Survey – Bedside Nurse Feedback

This confidential, voluntary, and anonymous survey evaluates bedside nurses' satisfaction with and experiences of the Virtual RN (ViRN) program. Your feedback is vital and will inform future improvements and support the continued integration of virtual nursing services. Please respond honestly based on your current experience. You may stop the survey at any time without penalty.

Thank you for your time.

Estimated time to complete: 5-10 minutes.

Are you willing to continue?

- Yes
- No

Section 1: Demographics

Question 1. What is your age range?

- Under 25
- 25–34
- 35–44
- 45–54
- 55–64
- 65 and older

Question 2. How many years of nursing experience do you have?

- 0–5 years
- 6–10 years
- 11–15 years
- 16–20 years
- More than 20 years

Question 3. What shift are you completing this survey during?

- Day Shift
- Night Shift

Section 2: Likert Scale Question

Instructions: Please rate the following statements using the scale below.

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Disagree
ViRN is readily accessible during my shift.					
ViRN adds value to bedside nursing.					
Communication with ViRN nurses is effective.					
The technology platform to access ViRN is user-friendly.					
I understand the ViRN admission and discharge process.					
I feel comfortable using ViRN.					
The roles between bedside and ViRN nurses are clearly defined.					
Using ViRN allows me to complete other patient care tasks more efficiently.					
Using ViRN saves me time in delivering nursing care.					

Section 3: Open-Ended Feedback

Question 1: What aspects of ViRN work well in your unit?

Question 2: What challenges have you experienced using ViRN?

Question 3: In your experience, what value or benefits does the Virtual RN (ViRN) program provide to you in your role?

Question 4: What improvements would you suggest for ViRN integration?

Appendix F

Weekly Email and Newsletter Reminder

Reminder: Share Your Feedback – ViRN Satisfaction Survey Still Open

Dear Team,

This is a friendly reminder to complete the **Virtual Registered Nurse (ViRN) Satisfaction Survey – Bedside Nurse Feedback** if you have not already done so. Your feedback is incredibly valuable and will play a vital role in shaping our organization's future of virtual nursing services.

The survey is **anonymous, confidential, and voluntary**. It will take approximately **5–10 minutes** to complete. Your honest insights will help us better understand your experience with the ViRN program and guide future improvements. If you are willing to participate, please complete by June 27, 2025.

You may stop the survey at any time without consequence.

To access the survey, please click the link below:

<https://redcapclin-prod.mayo.edu/redcap/surveys/?s=9HTNCN9KFRT8PRLX>

Thank you for participating and helping us enhance nursing care through innovation.

Please reach out with any questions or concerns.

Warm regards,

Joannie Schmidt
University of Arizona
DNP-Executive Health systems Leadership Student
JoannieSchmidt@arizona.edu

Appendix G**Overall ViRN Usage****Overall ViRN Usage January 1, 2025-April 30, 2025**

Unit	Total Number of Possibilities	Completed Possibilities	Percentage
1	1,442	486	33.7%
2	1,234	692	56.1%
3	1,608	778	48.4%
Total	4,284	1,956	45.7%

Appendix H

University of Arizona IRB



University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

NOT HUMAN RESEARCH

June 12, 2025

Joannie Schmidt

Dear Joannie Schmidt:

On 6/12/2025, the IRB reviewed the following submission:

Type of Review:	Initial Study
Title:	Program Evaluation of Virtual Registered Nurse (ViRN) Integration: Assessing Adoption, Quality Process, and Nurse Satisfaction in Inpatient Care
Investigator:	Joannie Schmidt
IRB Submission ID:	STUDY00006500
Sponsor:	None
Prime Sponsor:	None
IND, IDE, or HDE:	None
Documents Reviewed:	<ul style="list-style-type: none"> • Advisor Attestation, Category: Institutional Approval; • Disclosure Form, Category: Consent Form; • IRB-Protocol-for-Determination-of-Human-Research-v2025-03.docx, Category: IRB Protocol; • Mayo Clinic Agreement and IRB, Category: Other; • Recruitment Invitation, Category: Recruitment Materials; • RN Survey, Category: Other; • Weekly Email, Category: Recruitment Materials;

The IRB determined that the proposed activity is not research involving human subjects as defined by DHHS and FDA regulations.

IRB review and approval by this organization is not required. This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these

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University of Arizona IRB
845 N Park Ave., Suite 537A
Tucson, AZ 85719
Fax: 520-621-9810
VPR-IRB@arizona.edu

activities are research involving humans in which the organization is engaged, please submit a new request to the IRB for a determination.

All Covered Individuals must disclose all sponsored and non-sponsored Research Projects to the Office for Responsible Outside Interests (OROI) prior to Conducting Research if the individual is an Investigator. Please visit the [OROI](#) website for more information.

We value your feedback and would appreciate you taking the time to complete our survey about your experience with the IRB staff:

https://uarizona.col.qualtrics.com/jfe/form/SV_chQ04WxNA06b42j.

If questions arise at any time during your study, please email the general IRB inbox at VPR-IRB@arizona.edu.

References

- American Association of Colleges of Nursing. (AACN). (2006). *The essentials of doctoral education for advanced nursing practice*. Washington, DC.
<https://www.aacnnursing.org/our-initiatives/education-practice/doctor-of-nursing-practice/dnp-essentials>
- American Nurses Association. (ANA). (2025, April 23). *Principles of virtual nursing* [PDF].
<https://www.nursingworld.org/globalassets/docs/ana/ethics/principles-of-virtual-nursing.pdf>
- Boston-Fleischhauer, C. (2017). The explosion of virtual nursing care. *JONA: The Journal of Nursing Administration*, 47(2), 85–87. <https://doi.org/10.1097/nnn.0000000000000444>
- Centers for Disease Control and Prevention. (CDC). (2024, August 20). *CDC Program Evaluation Framework*. Centers for Disease Control and Prevention.
<https://www.cdc.gov/evaluation/php/evaluation-framework/index.html>
- DiCello, D., Evans, R., Ferguson, S., Garcia-Dia, M. J., Manzano, W., Lou Prado-Inzerillo, M., & Radosta, M. (2024). Virtual nursing is used to improve patient and team member experiences at New York-Presbyterian Hospital. *NEJM Catalyst*, 5(10).
<https://doi.org/10.1056/cat.23.0313>
- EpicShare. (EPIC). (2025, March). *Virtual nursing improves the patient experience and supports bedside nurses*. Advocate Health and WellSpan Health. Epic Systems Corporation.
<https://www.epicshare.org/share-and-learn/advocate-wellspan-virtual-nurse>
- Garcia-Dia, M. J. (2025). Exploring virtual models of care. *Nursing Management*, 56(6), 56.
<https://doi.org/10.1097/NMG.0000000000000269>
- Harder, K. A., Bloomfield, J. R., Sendelbach, S. E., Shepherd, M. F., Rush, P. S., Sinclair, J. S., Kirschbaum, M., & Burns, D. E. (2005, February). *Improving the safety of heparin administration by implementing a human factors process analysis*. *Advances in Patient Safety: From Research to Implementation (Volume 3: Implementation Issues)*.
<https://www.ncbi.nlm.nih.gov/books/NBK20570/>
- Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research Electronic Data Capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, 42(2), 377–381. <https://doi.org/10.1016/j.jbi.2008.08.010>
- Kurtović, B., Gulić, P., Čukljek, S., Sedić, B., Smrekar, M., & Ledinski Fičko, S. (2024). The commitment to excellence: Understanding nurses' perspectives on continuous professional development. *Healthcare*, 12(3), 379.
<https://doi.org/10.3390/healthcare12030379>

- Perpetua, Z., Seitz, S., Schunk, J., Rogers, D., Gala, J., Sherwood, P., Mikulis, A., Santucci, N., Ankney, D., Bryan-Morris, L., & DePasquale, K. (2023). Virtual discharge. *Journal of Nursing Care Quality*, 38(3), 234–242. <https://doi.org/10.1097/ncq.0000000000000689>
- Ransford, J., Tidwell, T., Johnson, L., Gitney, N., Morgan, A., & Hauch, R. (2024). Implementing a virtual discharge nurse pilot. *JONA: The Journal of Nursing Administration*, 54(11), 605–611. <https://doi.org/10.1097/naa.0000000000001498>
- Sakumoto, M., Knees, M., Rogers, K., Segon, A., Westergaard, S., Yu, A., Keniston, A., & Burden, M. (2024). Virtual hospital care development and deployment: A rapid qualitative study of frontline clinicians and leaders. *Journal of Hospital Medicine*, 19(8), 685–692. <https://doi.org/10.1002/jhm.13380>
- Schuelke, S., Aurit, S., Connot, N., & Denney, S. (2019). Virtual nursing: The new reality in quality care. *Nursing Administration Quarterly*, 43(4), 322–328. <https://doi.org/10.1097/naq.0000000000000376>
- Schwartz, R. L., Hamlin, S. K., Vozzella, G. M., Randle, L. N., Klahn, S., Maris, G. J., & Waterman, A. D. (2024). Utilizing telenursing to supplement acute care nursing in an era of workforce shortages. *CIN: Computers, Informatics, Nursing*. <https://doi.org/10.1097/cin.0000000000001097>
- Tibbe, M., Arneson, S., & Welsh, C. (2023). Rise of the virtual nurse. *AACN Advanced Critical Care*, 34(4), 314–323. <https://doi.org/10.4037/aacnacc2023391>