Implementing Virtual Nursing in Health Care: An evaluation of effectiveness and sustainability

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Abstract-As SARS-COV-2 or COVID-19 (COVID) increasingly spread across the world, nurses in the United States increasingly became at risk for contagion, as well as experiencing higher levels of anxiety and concerns related to safety in the workplace. The rise of COVID and the underlying desire to secure protections for healthcare workers created a higher demand for technology and online workspaces where clinicians can provide sustainable care for patients while also reinforcing the need for staff safety. To streamline the patient discharge process, increase patient safety, comprehension, and satisfaction, while simultaneously preventing undesirable readmission rates, a Virtual Nurse application, via remote monitoring and video capabilities, is expected to take over indirect patient tasks such as patient education, discharge instructions, pain monitoring, telemonitoring, communication with the primary nurse and others. By automation, the Virtual Nurse will alleviate repetitive and time-consuming tasks, thus, freeing up nurses to focus on direct patient care tasks and human-to-human quality interaction. This study strives to investigate the feasibility of the implementation of a Virtual Nurse role in the patient discharge process performed at a large healthcare system. This study will start by presenting a brief literature review focused on the technologies currently being employed in healthcare settings around the U.S. Our study aims to present the methodologies utilized in data acquisition and analysis, as well as population sample characteristics.

Index Terms—Virtual nursing, COVID-19, discharge process.

I. INTRODUCTION

As SARS-COV-2 or COVID-19 (COVID) has increasingly spread across the world, nurses in the United States have increasingly become at risk for contagion, as well as experiencing higher levels of anxiety and concerns related to safety in the workplace. The rise of COVID and underlying desire to secure protections for healthcare workers has created higher demand for technology and online workspace where clinicians can provide sustainable care for patients while also reinforcing the need for staff safety. The COVID-19 global pandemic greatly emphasized the need to continue incorporating telehealth and nursing technologies in healthcare systems. New approaches to providing efficient healthcare delivery were examined as a more detailed exploration of digital health care ensued. Due to continued advancements in technology, the need to further incorporate healthcare technologies heightens. The COVID-19 global pandemic required healthcare systems to greatly rely on telehealth and healthcare technologies. In the future, both technology and telehealth are required to continue providing healthcare to patients and transform healthcare delivery in virtual environments

Chronic nursing shortages further exacerbated by the pervasive ramifications of the COVID-19 are triggering a kneejerk reaction on the part of U.S. healthcare organizations to nimbly adapt and swiftly adopt innovative technological solutions in the race to deliver superior healthcare services in a fiercely competitive market. Chronic nursing shortages further exacerbated by the pervasive ramifications of the COVID-19 are triggering a knee-jerk reaction on the part of U.S. healthcare organizations to nimbly adapt and swiftly adopt innovative technological solutions in the race to deliver superior healthcare services in a fiercely competitive market.

This study strives to investigate the feasibility of the implementation of a virtual nurse role in the patient discharge process performed in a large healthcare system. The discharge process represents the most critical step of the patient flow process as it has been linked to medication adverse reactions, impaired comprehension of instructions due to low literacy levels or language barriers, and increased risk for emergency department readmissions [1]. In an effort to streamline the patient discharge process, increase patient safety, comprehension, and satisfaction, while simultaneously pro-actively preventing undesirable readmission rates, the virtual nurse application, via remote monitoring and video capabilities, is expected to take over indirect patient tasks such as patient education, discharge instructions, pain monitoring, telemonitoring, communication with the primary nurse and other tasks deemed appropriate. By automating such tasks, the virtual nurse will alleviate repetitive and time-consuming tasks; thus, freeing up nurses to focus on direct patient care tasks and human-to-human quality interaction [2]. The implementation and evaluation stages of the virtual nurse prototype will be informed by the Consolidated Framework for Implementation Research or CFIR which includes five major domains-interventions characteristics, outer setting, inner setting, the characteristics of the individuals involved and the process of implementation-to guide prototype implementation and evaluation of the virtual nurse impact on patient safety and satisfaction as well as nurse satisfaction and retention. This pilot study will start by presenting a brief literature review focused on the disruptive technologies currently being employed in healthcare settings

around the U.S. Next, it will present the methodologies utilized in data acquisition and analysis, as well as population sample characteristics.

II. LITERATURE REVIEW

Emerging interest in virtual spaces that improve healthcare has been a developing area of clinical care, science, and technology. Mehta, et al. sampled ICU physicians, nurses, and other healthcare professionals with a survey on clinical redundancy and comprehension [3]. Using a checklist and internet survey, researchers investigated clinicians' level of risk, knowledge of procedures, coping strategies during COVID stress, and opportunities for improvement in process. Mehta, et al sampled a total of 485 respondents with 455 total actual responses during the survey. Open ended responses were recorded into three areas for analysis: personal coping and wellness, impact on family life, and relationship with the community. These responses highlight the ongoing need for improved support for nursing and clinical healthcare staff during the pandemic. This study concluded that not only do new workforce strategies need to be employed to greater empower and protect clinical staff members, but also there is a great need for emotional and wellness support for staff members. Public health interventions have focused on the interactions between clinicians and patients, alike; however, few interventions target the clinicians themselves. Through increased access to education, training, counseling, and wellness support, the experiences of nurses and healthcare workers could be better enhanced. Virtual spaces and technology are one support mechanism currently being explored to assist in these efforts. Schneider, Smith, & Howard documented several potential solutions to staffing issues in the nursing field. One such strategy was the idea of floating out of your own unit as a nurse. Prior to the pandemic, these were less frequent occurrences for nurses on a staffing floor [4]. However, this solution has posed some benefits to assisting when more resources and staff are needed on a particular task or for specific patient care. In addition, offering extra shifts, postponing time off, recruiting nurses from retirement, and added trainings or cross trainings were said to increased staff availability and provide increased support during high stress events. It is also noted that these methods may add to increased emotional stress with regard to nursing staff, as many were reported to already be on multiple 16-hr shifts within a week. Researchers found a greater need for work-life balance for nursing staff to minimize the effectives of pandemic-related stress. Nurses are a cornerstone of the healthcare system; and as such, should continue to be supported through initiatives in the workplace that secure mental and physical wellness while providing adequate resources for workflow management.

Bhatia acknowledges the importance of health technologies in healthcare and healthcare systems. Health technologies provide solutions to improve healthcare systems and ultimately improve healthcare [5]. The World Health Organization (WHO) defines health technology as the application of organized knowledge and skills in the form of medicines, medical

devices, vaccines, procedures, and systems developed to solve a health problem and improve quality of life. Technology is continuing to advance and improve, and thus, will provide transformations and improvements in health technology. While health technology is important to healthcare, it is also important to manage these health technologies. The health technology assessment is an important and necessary step in health technology management. The World Health Organization defines the health technology assessment as the systematic evaluation of properties, effects and/or impacts of health technology. It is a multidisciplinary process of evaluating the social, economic, organizational, and ethical issues of a health intervention or health technology. As technologies provide a huge support in health systems, health technologies can also be extremely cost sensitive. To ensure that health systems are appropriately allocating funds to health technologies, assessment of health technologies and equipment must take place and practices to manage appropriate medical devices must be put in place as well. Health systems must acknowledge the influence of health technologies and plan for proper use and management of these technologies.

Researchers have been investigating the impact and convergence and technology and medicine for some time. Bourgault et al. researched the importance of technology and VS and focused on the impact of virtual systems on clinical care [6]. Researchers created a virtual nursing simulation for students to evaluate both the effectiveness of the application and the student's knowledge of content and clinical expertise. An exam was provided for students in order to evaluate course knowledge and evaluate the system as a whole as a viable option for clinical training. Not only did this system show increased competency in the training modules for nurses, it also presented economical value with regard to cost for care, education, and treatment. While patient care may continue to be the focus for many during a COVID world, increasing access to services that benefit the training of nurses is equally valuable and important for recruitment and recidivism of nurse practitioners. Researchers concluded that using the VS not only benefited student nurses, but also clinical care, and the health care system as a whole. As a result of findings in the literature review, we intend to investigate the impact of implementing a virtual nursing application for as a solution to clinical care. Through an evaluation of the effectiveness of the usefulness and nursing satisfaction, our goal is to provide more research on potential solutions that benefit both patients and clinicians.

III. METHODS

1) Participants Recruitment: A homogeneous sample comprised of 12 male and female nurses specialized in patient discharge of various ages and experience levels will be identified, selected, and assembled into distinct focus groups by leaders of this large healthcare system. All participants are currently employed by this healthcare entity. Our aims are: **Aim 1:** Explore the feasibility of implementing a virtual nurse role. Feasibility includes cost, operation, staffing, ease of implementation, and staff acceptance of the virtual nurse. **Aim 2:** Characterize the effect of the virtual nurse role on patient satisfaction, nursing care documentation, patient safety, nurse satisfaction, and nurse retention.

2) Data Collection: Participants will be randomly assigned to one of four focus groups comprised of three members each. A different focus group will convene virtually via Microsoft Teams with the research team every Friday from 1630 to 1739 Standard Eastern Time for a total of four virtual sessions. At the end of this interview cycle, a fifth group comprised of leaders and administrators of this large healthcare system will meet with the researchers using the same setting, Microsoft Teams.

3) Data Collection Instruments: Two participant-centric questionnaires were developed and used to guide semistructured interviews with nurses, leaders, and administrators. In addition, NCRs (patient satisfaction surveys), Epic (nursing care documentation), and Safer (safety reports) will be utilized in conjunction with the qualitative data yielded by the semistructured interviews.

4) Questionnaire Development: This questionnaire was developed by reviewing the needs and responsibilities of focus group participants in healthcare and how this virtual nursing system could assist with alleviating those needs and responsibilities. The questionnaire into two types of questions: nurse-specific and executive, admin specific questions. Both question types consist of restricted and unrestricted questions. The restricted questions (examples below) ask the participants to make a yes or no answer choice while the unrestricted questions are open-ended and allow participants to expound on their answers.

5) Sample Questionnaire:

Q1: What are the most critical steps of patient discharge?

Q2: What tools or software are currently utilized to assist with the discharge process?

Q3: How long does the discharge process typically take on average?

Q4: Is there a generic printout of discharge instructions for every patient or an individualized discharge plan?

Q5: What improvements can be made to make the patient discharge process more efficient?

IV. CONCLUSION AND FUTURE WORK

Despite its widespread negative impact on the nursing workforce, the COVID-19 pandemic has also spurred the rapid development, proliferation, and implementation of avant-garde technological solutions such as telehealth services, remote patient care platforms, and AI-based smart applications in the healthcare setting. Healthcare organizations around the country are searching for and heavily investing in viable and creative solutions to prop up and even enhance their nursing workforce, the largest segment of their human capital. As such, progressive organizations are pioneering and introducing stateof-the-art technologies of varying complexity and scope to promote positive, supporting work environments for nurses, increase nurse job satisfaction, deploy adequate nurse staffing ratios, and promote "equity of nursing workload," [7], as well as patient safety and satisfaction via patient-centric care delivery models. The Virtual Nurse prototype discussed in this article represents an example of innovation, dedication, and commitment to deliver superior patient care while concomitantly supporting and enhancing the nursing workforce at this large healthcare system under investigation. By integrating the Virtual Nurse Application into the patient discharge process, a positive, robust, and highly functional partnership is expected to emerge between nurses and technology, a seamless working relationship conducive to patient safety and satisfaction as well as nursing workforce well-being and retention. As such, by automating indirect patient tasks such as education, responding to call lights, telemonitoring and much more, the Virtual Nurse alleviates repetitive and mundane tasks, thus, enabling nurses to focus on direct and fundamental tasks that require quality human interaction. This technology-nurse partnership is expected to streamline the discharge process, save time and effort, and prevent miscommunication and misunderstanding of discharge instructions and ultimately reduce the incidence of avoidable patient readmission rates. In addition, this collaboration is expected to promote a supportive and highly satisfying work environment for nurses conducive to low turnover rates and workforce retention. The Virtual Nurse Application will initially be deployed in select patient discharge units to validate feasibility. Upon successful implementation, deployment and testing, further iterations will be developed and continuously improved until a highly functional, adaptive, and efficient application is secured and successfully integrated into the patient discharge process at this large healthcare system. The Virtual Nurse Application demonstrates that change and unpredictability can be met with innovation, courage and can serve as inspiration for other healthcare systems that desire to remain relevant and competitive in the post COVID-19 world.

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