Artificial Intelligence in Telemedicine:

Integration in the Nursing Process

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The last century has been an incredible period of technological advancement. While all aspects of life have been touched by these advancements, healthcare requires special consideration. The use of technology in healthcare can save lives and the demand for advanced healthcare is increasing due to the ability to keep people alive with multiple chronic diseases. Management of patients has become increasingly challenging while there has been a growing shortage of both primary care physicians and nurses. Providing adequate access to quality healthcare for all has proven to be a formidable proposition indeed. The current pandemic has shined a spotlight on not only these challenges but on one of the most likely solutions: Telemedicine. Whether it be websites, video conferencing (virtual appointments), telephone services, or any other technologically enhanced platforms, more and more healthcare is taking place in settings other than physical face-to-face environments. This trend does not appear to be slowing. This paper investigates the probable future that artificial intelligence (AI) has in telehealth nursing and conversely the future that nursing needs to play in AI telehealth.

A precursory glance at healthcare in practice reveals that much of what is taught to practitioners is based on algorithms and decision trees. These pathways are based on research evidence showing correlations and outcomes that incorporate enormous amounts of data and complicated theoretical models. They are based on presenting signs and symptoms, patient characteristics, environmental factors, other disease processes present, and considerations of medications the patients are taking. Such intricate conglomeration of data and applications fit well into the models of deep learning (DL) and deep neuro networks (DNN) in the realm of AI (Robert, 2019). The increasingly complicated nature of the information needing to be

evaluated and integrated into patient care models creates a need for increased efficiency that AI can provide (Leventhal, 2018). Some research is already utilizing AI in the processing of huge amounts of information in healthcare. Since health care is constantly updating from this information, clinical judgment can be greatly enhanced by the rapid processing of data. AI is already being used for data analysis and pattern recognition in research (Bhattacharya et al, 2019; Jiang et al, 2017) and is pegged for quality improvement of practice and developing new models of care (Kuziemsky et al, 2019).

Elaborate approaches to healthcare are necessary for many reasons: 1. There are financial pressures to treat patients out of the hospital as much as possible. 2. People are living with multiple chronic diseases, which used to be deadly. 3. Patients are on multiple medications with side effects and adverse reactions (see the previous point #2). 4. The environment is offering an unprecedented amount of toxic and detrimental exposures daily. Since every human has differences in body chemistry, genetic make-up and predispositions, and diseases present differently based on the patient's characteristics and the environment, AI seems to be a necessary tool for the complicated future of telehealth.

To assimilate into nursing telemedicine, AI technology must support the Nursing Process. This is an organized method used by nursing to promote sound clinical judgment by identifying patients' needs, establishing a plan of interventions, and promoting outcomes of improved health and function. The Nursing Process includes **Assessment**: Gathering information (history, signs and symptoms, etc…, **Diagnosis**: Grouping assessment information into issues that nursing can address. **Plan**: Considering which evidence-based interventions are needed and how to tailor them to the individual patient needs. **Intervention**: Execute the plan.

Evaluation: Review to see if outcomes are met or if further adjustments to plans and interventions are needed. The next few paragraphs show how it is easy to see how AI is already assisting in each of these steps and how it can enhance nurses to deliver even better health care through telemedicine in the future.

Interviewing patients for symptoms, obtaining vital signs (blood pressure, pulse, temperature, respiration rate, pain level…), and video **assessments** are all part of nursing's first process steps in telemedicine. These assessments could be assisted and improved by AI especially with machine learning and speech recognition (Bhattacharya et al, 2019; Jiang et al, 2017; Denecke, 2019). Automated gathering of patient data in such a way would streamline the triage process and free the nurse to more thoroughly consider the data and focus on clinical judgment in **diagnosing** the nursing issues. Then in the **planning** phase of the nursing process, AI can incorporate telemetric-data and research analysis into new suggestions. Information from cases being treated can be assimilated with known evidence and the patient's medical record information. AI can then recognize patterns and offer both patient-specific models and contribute to more general models of care (Kuziemsky et al, 2019; Pepito & Locsin, 2019). The focused plans utilizing nursing clinical judgment and AI output/suggestions could then create more robust and productive **implementations.** This utilization of AI for implementing nursing and medical interventions is already being practiced. Notably, it is used in fine-tuning disease-specific treatments like heart failure (D'Amario et al,2020) and diabetes (Tyler & Jacobs, 2020). AI also assists patients in participatory care projects like weight loss (Stein & Brooks, 2017) and guiding patients in their health education needs (Denecke, 2019). In the same vein, AI currently assists in the **evaluation** and monitoring of interventions to assure either a positive outcome or

early detection and treatment of complications to avoid negative outcomes. Home health patients have vital sign machines sending info to computers that identify and alert nurses to respond. There are assisted living Smart Homes that have sensors and AI computers that identify patient behaviors and can redirect patients or alert caregivers under a nurse's guidance (Dermody & Fritz, 2019). Implanted monitors can give large amounts of data on heart function parameters like cardiac pressures, hemodynamics, and rhythms (D'Amario et al, 2020, Kuziemsky et al, 2019).

The nursing process in telemedicine has benefited from the offerings of AI. Likewise, there are several reasons that AI in telemedicine can benefit from nursing. Nurses have had to incorporate new technology at incredible rates over the last several decades. Nurses' inputs have always been key in assuring a positive end-user experience, so user interfaces would make more sense and be more useful if they were shaped and fashioned by the hands of experienced and knowledgeable nurses. The content delivered via AI would also be enriched by nursing. Physicians prescribe general treatment using the biochemical models, but details of what patients need to know in response to their disease have always been the domain of nursing. The functional and practical knowledge patients need in their daily life should also be delivered through telemedicine and this is unique nursing knowledge. For AI to offer comprehensive support, nursing-specific knowledge must be considered. It is up to bedside nurses and nurse leaders to shape AI responses and put them in the context of holistic care (Pepito & Locsin, 2019; Risling & Low,2019). Furthermore, the role of the nurse is often that of the coordinator of the multiple disciplines. Telemedicine support would have to include knowledge of multiple disciplines and the algorithms developed would have to bridge back and forth among these

different disciplinary domains and models. Nurses have some insight into all disciplines as well as ways to prioritize and administer interventions from among the disciplines (Pepito & Locsin, 2019; Risling & Low,2019). Arguably the most important role nursing might play in the future of AI's role in telemedicine relates to delivering compassionate care. Patient-centered care must be sensitive, individualized, and humane. For AI to accomplish this there must be cooperative efforts between nursing and technology developers to root responses not only in the biological sciences but in psychology and those "soft" interpersonal skills that many nurses have mastered. Patients have better outcomes (compliance, motivation, even some chemical markers) when providers show care and compassion. Nurses can assure such an approach even with AI assistance (Buchanan et al,2020; Pepito & Locsin, 2019; Risling & Low,2019).

Ultimately the relationship between nursing and AI will have to be symbiotic. AI fits nursing in that nursing already utilizes decision trees and algorithms based on vast amounts of research data which matches how AI functions. AI's ability to assimilate huge amounts of information to support clinical judgment is a natural fit and will continue to become more important as patients are becoming increasingly complicated. AI also fits nursing because it is easily incorporated into the Nursing Process. Current ways that AI is utilized in the Nursing Process needs to be expanded and reinforced. These include **Assessment and Diagnosis** – Triage and symptom screening with appropriate referrals; **Planning -** Incorporate tele-data and research analysis into new models and patient-specific care plans; **Implementation** - Disease management and participatory care; **Evaluation and Monitoring** - Telemetric vitals, implantable monitors and follow-up communications. Likewise, nursing should be utilized in the development of telemedical AI. Nursing will contribute to a friendly, functional user

interface and offer data input with nursing expertise and knowledge that is different than physicians. Nursing can also help bridge interdisciplinary perspectives while assuring compassionate, patient-centered care for the patient users. The synergy of nursing and AI holds enormous potential with limitless benefits for patients and the health of people in general.

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