

The synthesis of nursing knowledge and predictive analytics

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As healthcare organizations enter the maintenance and optimization phases of electronic health record (EHR) implementation, the time has come for us to leverage the vast amounts of data generated by the EHR and associated technology to improve information sharing and deliver excellent clinical care and patient experience. The evolution from simple data collection to aggregating, tracking, trending, and analyzing big data to enhance care is in flight. Now, the ability to use even more advanced data manipulation techniques for care planning and delivery is, in many cases, required to meet the needs of modern nursing practice.¹ Through the application of emerging technologies, such as predictive analytics and machine learning, nurses can add tremendous value to the future of care delivery and operations.

Nurses as knowledge workers

Nurses are knowledge workers, performing highly variable, focused work that involves a significant amount of information.² In our daily work, we use our specialized nursing skills to compile, sift through, and find actionable solutions using disparate data sources and large datasets. With explicit knowledge of clinical science and by applying the nursing

process and critical thinking, nurses instinctively take discrete data elements and organize them into information to use in every patient experience. The application of our nursing knowledge and experience, married with successful data handling, allows us to make critical decisions at the point of care. The result is nurses disseminating wisdom and the



improved application of evidence-based practice, adding immeasurable value to the clinical setting and moving toward improving the health of populations and communities. Through advanced data analytics, we can use this information to our advantage and distribute the subsequent wisdom with greater impact.

Studies have shown that nurses spend upwards of 50% of their time recording and managing this assimilated information.³ By using acquired patient data, nurses gain information and apply knowledge to guide practice.⁴ Nursing knowledge identifies information and creates relationships so it can be synthesized and formalized.² These relationships leverage the nurse's ability to apply inferences to information and make a judgment to determine patient progress toward expected outcomes or identify nursing problems and interventions appropriate for the challenge. A set of vital signs is information; however, the interpretation of that information as abnormal indicates knowledge.⁵ Increasingly, new ways of using data enhance the clinical experience by allowing nurses to make informed, data-driven decisions.

Today's nurses need constant involvement in technical innovation to stay current and forward-thinking in care delivery.⁶ To that end, technologic advances enabled through the EHR, medical claims, patient prescription history, and digital sensor data now allow nurses to provide more precise, higher quality, and safer care. The application of emerging technologies enables nurses to reap the benefits of data manipulated through nonhuman processing, accelerating and expanding nursing

knowledge generation and prioritizing care based on patient needs.

Applied predictive analytics

Advanced computational analysis of healthcare data, particularly predictive analytics, can help nurses unearth unidentified trends within multiple sources of data. Predictive analytics is the statistical science of data analysis that discovers various patterns.⁷ By applying computational models and analysis, nurses can draw on historical,

Machine learning methods take historical data and compare them with current data to predict what will happen in the future. With every refresh of new data from designated sources, the machine learns how to be more precise in predicting.¹⁰

Predictive analytics and machine learning in clinical care function as “assistive intelligence.”¹² Nurses’ critical thinking is still needed to assess the clinical situation, synthesize the derived information to

gence of predictive analytics and machine learning along with nursing knowledge can keep patients from:

- rapid deterioration. Predictive analytics can help nurses identify when a patient is declining by sending a warning or risk score based on patient-specific data, such as vital signs and lab or radiology results, along with external data sources from sensors and remote devices.¹⁴ A machine-assimilated risk score, in addition

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present, and simulated future data to provide actionable insights into real-world clinical and operational problems.⁸ Predictive analytics allows a machine approach to refine these data and extract hidden value from the newly discovered patterns to dynamically inform data-driven decision-making so we can know what will happen in healthcare settings, when, and what to do about it.⁹

Further robust exploration of data is needed to harness the power of prediction in clinical care. The addition of advanced algorithms through machine learning is a way to guide and standardize best practices and expedite treatment. Machine learning is the study of computer algorithms that improve automatically through experience.¹⁰ It’s a form of artificial intelligence that enables software applications to become more accurate in predicting outcomes without being explicitly programmed.¹¹

make the best decision, and put the decision into action. Although human judgment is paramount to the success of predicting trends and identifying variation, the use of algorithms is promising in attaining the best outcomes, expounding on existing clinical decision support systems, and adding a helpful layer of precision. Looking toward the future, nurses can count on advanced technologies to drive cutting-edge, enhanced practices and research-based evidence to the point of care to help make the most complex clinical decisions with a higher degree of confidence.¹³

Using data for prediction

Nurses have the influence to proactively adopt and expertly apply emerging technologies, adding value to care delivery by making the best data-driven decisions to improve outcomes and patient experience. Using the assistive intelli-

to patient assessment and presentation, quickly enables nurses to determine if the patient’s status is indeed declining, which allows us to begin immediate care, prevent further deterioration, and move the patient to a higher level of care if needed.

- staying in the hospital for too long or not long enough. An aggregate of the patient’s demographics, comorbidities, number of medications, and lab and vital signs values derived from the EHR can determine the risk of readmission. Understanding a patient’s risk of rehospitalization powered by advanced analytics such as machine learning will better enable nurses to personalize care, discharge planning, and outpatient care needs earlier—all factors that can prevent rehospitalization.¹⁵ Conversely, with predictive analytics, nurses can recognize what may inappropriately lengthen a patient’s stay, such as ineffective medication

management, missed treatments and procedures, and not meeting discharge criteria.

- failing to receive the best options at end of life. Predicting mortality using machine learning is also on the horizon. Machine learning algorithms interpret multiple data sources, including the EHR, medical claims, and geographic data, to discover patterns indicating imminent mortality in patients.¹⁶ Predictive analytics can help nurses lead data-driven critical conversations to ensure that patients receive appropriate care. These knowledge-derived discussions help patients and family members consider the best care options approaching death, including palliative and hospice care. Using analytics can aid nurses to engage patients and families with end-of-life choices to improve quality of life.¹⁷

Into the future

The value of nursing knowledge synthesized with predictive analytics enables the provision of evidence-based care and the promotion of safety, quality, and appropriate patient outcomes—the end goal of using all health information technology. Emerging technologies, such as predictive analytics and machine learning, will strengthen our ability to collect data, assimilate these data into information, apply newly discovered knowledge, and gain wisdom to improve care delivery. Moving forward, we'll use these technologies to enhance EHR clinical decision support tools and help optimize operational workforce issues such as inadequate staffing through more precise scheduling. We'll also decrease inefficiencies that hinder caregiver satisfaction, such as breakdowns in multidisciplinary processes and patient throughput,

and become key players in solving the challenges of transitional care. Harnessing the power of using data to extract valuable patterns to inform better decision-making gives nurses an edge in healthcare. We'll collectively add influence as we provide appropriate, evidence-based care and advance the nursing profession. **NM**

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