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Big data in nursing: What should we know?

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Abstract
Big data is a term for data sets that are so large or complex that traditional data processing application software is inadequate, which is described in 4As i.e. Volume, Variety, Velocity, and Veracity. Few examples of big data are Clinical data, Insurance and cost data, Patient behaviour & sentiment data and Research data. The use of big data technologies can help nurses and other healthcare providers improve care quality, optimize outcomes, and reduce the cost of healthcare. The ability for nurses to make optimal clinical decisions in the clinical area is dependent on having access to accurate, real- time information regardless of care setting. Currently, there are no agreed- upon rules for which data standards and nursing terminologies should be used, thus nursing documentation remains inconsistent even within a single hospital that has adopted a single nursing terminology. With inconsistent documentation and lack of agreement on standards, nursing data can't consistently be used for quality measurement or improvement.

Keywords: Big data, nursing, healthcare

Introduction

The pace of technological evolution in healthcare is advancing. The advancement of information and communication technology (ICT) is one of the most significant factors influencing change in healthcare systems around the world [1]. Understanding big data is a priority for nurse leaders as they aim to provide the best possible care to patients [2]. The data that comprise the elements of health information continue to expand in volume and complexity, the crux of "big data" is within the ability to analyze and use it in a meaningful way for continuous improvements [2]. Nurses in every setting contribute to big data and can improve nursing care with patient, nurse, and financial outcomes [3]. There is wide recognition that, with the rapid implementation of electronic health records (EHRs), large data sets are available for research [1]. The use of big data in healthcare continues to generate intense interest [1]. The movement from paper-based systems to Capability electronic health record (EHR) systems is what's enabling us to consider the potential power of big data [2]. One of the most beneficial advantages of using electronic clinical documentation systems is that they offer the ability to enter data once and reuse them multiple times [2]. Advances in computing, information science, and connectivity can improve patient-clinician communication, the point of care guidance, the capture of experience, population surveillance, planning and evaluation, and the generation of real-time knowledge-features of a continuously learning healthcare system [2].

What Is Big Data?

Big data is a term for data sets that are so large or complex that traditional data processing application software is inadequate. It has most frequently been described as the (4Vs -) Volume, Variety, Velocity, and Veracity [3]

- **Volume:** The volume of data being created today is growing exponentially with the increase in EHRs, medical device and monitoring data, genomic data and so on.
- **Variety:** The variety of data elements requires standardization and normalization in order for any meaningful comparisons or integration to occur.
- **Velocity:** Our ability to use data is challenged by the rapid speed at which data is being created (velocity) and the need for analysis to occur in near to real time.
- **Veracity:** The veracity of data is an important factor, in terms of the need for data integrity, accuracy, and trustworthiness [3, 4]

The standards and technology building blocks will enable quality improvement data sharing and, thus, "big data."4 The data in Health Information Technology, including patient-generated and claims data, will be standardized, linked at the individual level to clinical data as appropriate, and optimized for interoperable sharing and aggregation [4].

Definition of Big Data: The McKinsey Global Institute defines big data as "datasets whose sizes are beyond the ability of typical database software tools to capture, store, manage, and analyze." [2, 5] The data that comprise the

elements of health information continues to expand in volume and complexity, the crux of "big data" is within the ability to analyze and use it in a meaningful way for continuous [2]. As technology advances over time, the size of datasets that qualify as big data will also increase [5].

Examples of big data in nursing
• Clinical data
• Insurance and cost data
• Patient behaviour and sentiment data
• Research data [6]

Benefits of Big Data
• Having access to the right information at the right time to support clinical decisions is essential in planning and providing the right care for patients [2]
• The use of big data technologies can help nurses and other healthcare providers improve care quality, optimize outcomes, and reduce the cost of healthcare.
• Helps nurses to access to realtime information to make timely, critical, clinical decisions.
• Nurses may consistently use big data for research or reporting quality and patient safety outcomes.
• In a more coordinated structure, information can be easily and safely shared among patients, consumers, clinicians, and providers to enable improved outcomes, quality of care, and lower costs.
• Helps in evaluating the benefits of big data is the ability to use it for research and education [2].
• A learning healthcare system requires that data and information are collected as a byproduct of care. This capability will allow care teams to develop solutions to improve the health of the individuals receiving care and measure the effectiveness of their actions. This process creates a continuous feedback loop that not only leads to quality improvement but also supports more rapid translation of research findings into better care [4]

Priority for Nurses to Understand and Utilize Big Data
Understanding big data is a priority for nurse leaders as we aim to provide the best possible care to patients. Working in healthcare organizations with complex information technology and networks with multiple clinical, financial, and claims systems that must be integrated, set the stage for the big data challenge. The ability to integrate disparate data and analyze it to better understand outcomes is no small task. Having access to the right information at the right time to support clinical decisions is essential in planning and providing the right care for patients. All clinicians need real-time information to make timely, critical and clinical decisions. The use of big data technologies can help nurses and other healthcare providers improve care quality, optimize outcomes, and reduce the cost of healthcare [6] There are several challenges that further impede the implementation of nursing terminologies and information structures within EHRs, and their subsequent use for research [7].

Preparing for the Big Data Future
Today, Electronic Health Records are not the only resource for big data. Increasingly, medical and nursing data are being generated by patients and processed by computers.

Using wearable wireless sensors, we can use our smartphone to generate our own medical data, including measuring the blood level of oxygen and blood glucose levels, Blood Pressure, and heart rhythm. Sophisticated medical imaging devices are being miniaturized to replace the stethoscope. Patient-generated data are also flowing into traditional Electronic Health Records. The relevant data are tracked and analyzed; we can spot trends and interactions that no one system or program could detect alone. But to do so, we also need to protect the privacy and security of the data, and we need analytics to be able to extract meaningful information.[2] The potential value that can be gained from these innovative technologies is great, but the necessary behaviour change to depart from traditional practices will be challenging for both individuals and professionals [2].

How Can Nurses Leverage Big Data?
The ability for nurses to make optimal clinical decisions in the clinical area is dependent on having access to accurate, real-time information regardless of care setting. Data must also be structured in standard ways to enable sharable, comparable information. The value of consistent and accurate data can be realized through interoperable systems, advances in Electronic Health Records, and the alignment of clinical standards and terminologies. Nurses were among the first professional groups to standardize our terminology. But the pure number of terminology options makes such standardization difficult. Data and information sharing in nursing are in a weak position due to the inconsistent use of data standards and terminologies. Cross-system interoperability is limited, which results in the lack of comparability and consistency of nursing data. Currently, there are no agreed-upon rules for which data standards and nursing terminologies should be used, thus nursing documentation remains inconsistent even within a single hospital that has adopted a single nursing terminology. With inconsistent documentation and lack of agreement on standards, nursing data can't consistently be used for quality measurement or improvement [2].

Recommendations
• Capturing health and care data in a structured way helps to put up the foundation for accurate, reliable, clinically meaningful measurement across systems and settings of care [2].
• Using data elements constantly and consistently will also allow for information to be collected once and reused for multiple purposes, including outcomes measurement, practice level improvements, surveillance, population health, research, and decision support [4].
• Nurses should promote the use of standardized and accepted terminologies that address the documentation needs of the entire care team regardless of care setting. Also, minimize the use of free text documentation.
• Advance Quality e Measures: Paper measure sets must be evaluated for appropriateness, and expectations set for which data should be collected, how the data is collected and the required terminologies to be used.
• Leverage Nursing Informatics Experts: Healthcare organizations should utilize Nurse Informaticists who will provide valuable insight into concept

representation, design, implementation, and optimization of health Information technology to support evidence-based practice, research, and education. Nurse Informaticists should have formal informatics training, education, and certification [6].

Guidelines for Documentation That Promote Big Data Use

Nurses in every setting contribute to big data through their documentation in the Electronic Health Record (HER) in a sharable and comparable way. Standardizing documentation enables researchers to retrieve the valuable assessments that nurse's document. This list of six practices can help every nurse contribute to nursing's ability to use big data to improve patient care.

1. Use and document according to, evidence-based practice standards: The EHR should reflect the standards of care for a given patient population.

2. Document consistently, using a standard terminology: Nurses have many different ways of saying the same thing, making it difficult to compare a patient's progress over time or to identify the effect of an intervention across many patients. Without clear standards, one nursing unit may document "hypoxia" while other documents "shortness of breath" and a third documents "SOB."

3. Limit the use of free text: Free text typically isn't sharable or comparable. Although so-called crawlers are available to collect words or themes, such data are difficult to share or compare. Work with your data governance committee to find discrete and consistent terms for information your unit documents regularly.

4. Support research sponsored by organization or association: Clinical research improves our ability to care for patients. It doesn't happen unless frontline nurses learn about and document based on the questions being asked. Membership in professional nursing organizations helps us work together to make sure nursing-sensitive outcomes are used to measure the effectiveness of care.

5. Learn about nursing informatics: This speciality integrates nursing science with multiple information management and analytical sciences to identify, define, manage, and communicate data, information, knowledge, and wisdom in nursing practice [3].

Conclusion

Understanding the principles, barriers, challenges, and opportunities for big data will help us more rapidly ensure that sharable and comparable nursing information is included in EHRs and that all aspects of the nursing profession are knowledgeable about the potential of big data to transform practice, research, and education. Foundational to integrating nursing data into clinical data repositories for big data and science, is the implementation of standardized nursing terminologies, common data models, and information structures within EHRs.

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