CE

2.0
CONTACT HOURS

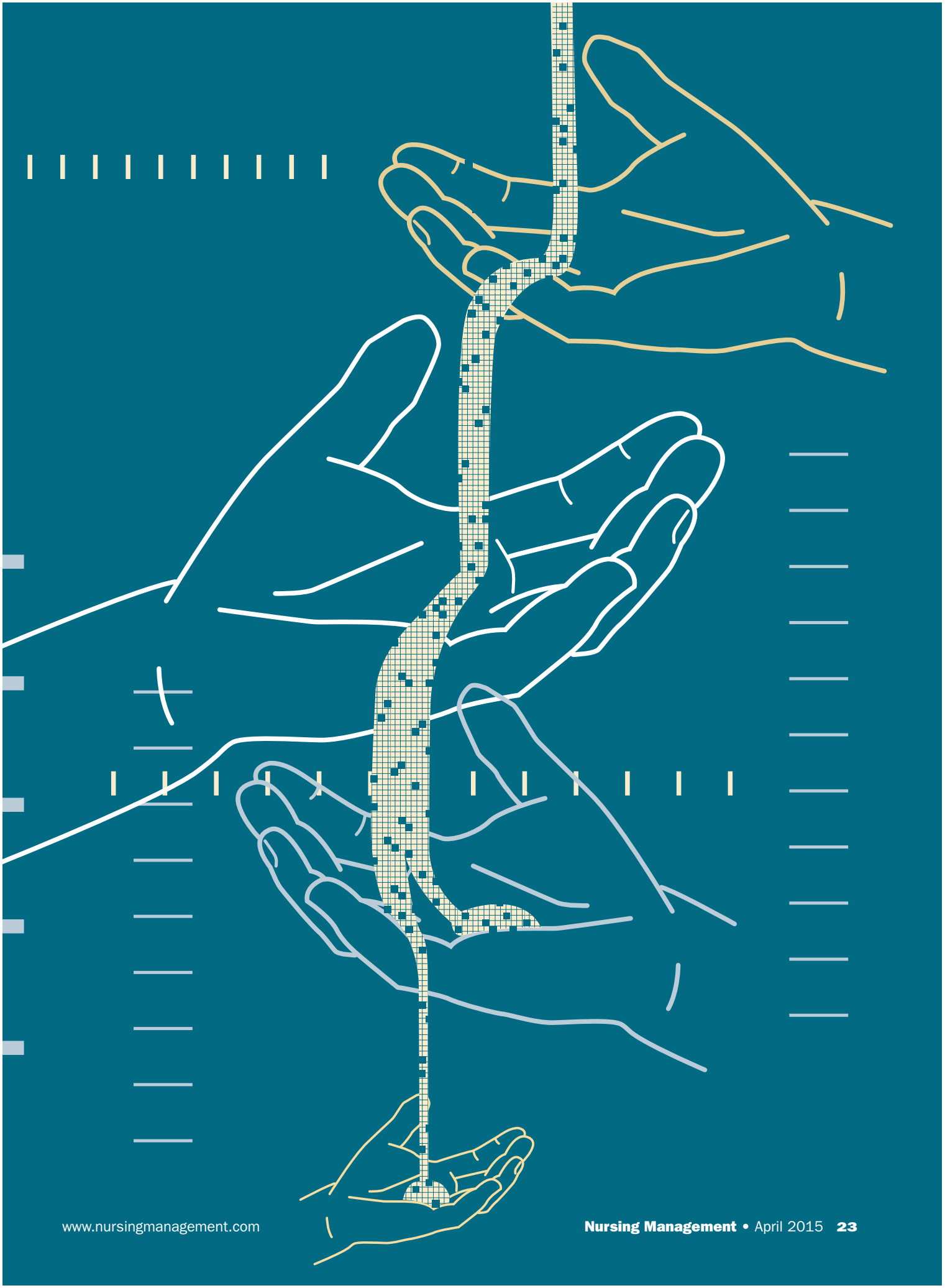
BIG DATA and the future of nursing knowledge

How can we use these technologies to improve care quality, optimize outcomes, and reduce healthcare costs?

By Joyce Sensmeier, MS, RN-BC, CPHIMS, FHIMSS, FAAN

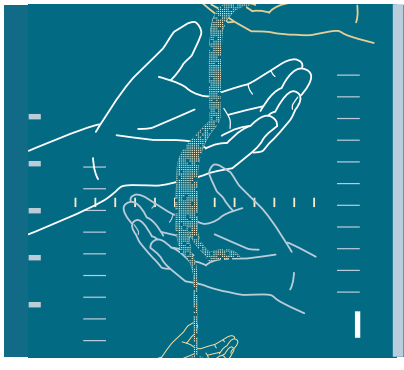
Documentation is an essential part of our work, and it becomes a communication vehicle for healthcare providers to tell the patient's story.[1] Data are at the core of that documentation; we spend an inordinate amount of time annotating the patient care that we deliver. Capturing health and care data in a structured way helps build the foundation for accurate, reliable, clinically meaningful measurement across systems and settings of care. Using data elements consistently and reliably 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.[2]

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 sets the stage for the big data challenge. The ability to integrate disparate data and analyze them 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, 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.[3]



Defining big data

So what exactly is 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."[4] Although 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.[3] The movement from paper-based systems to electronic health record (EHR) systems is what's enabling us to consider the potential power of big data.



The crux of "big data" is within the ability to analyze and use it in a meaningful way for continuous improvements.

According to the Institute of Medicine (IOM), an EHR system has several key capabilities:

- allows longitudinal collection of electronic health information for and about persons
- provides immediate electronic access to person- and population-level information by authorized users
- provides knowledge and decision support to enhance the quality, safety, and efficiency of patient care
- supports efficient processes for healthcare delivery.[5]

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. This capability reduces redundancy and can minimize errors by providing access to information from previous encounters. If a patient is readmitted, the previous data can be reviewed and validated or updated, thus reducing data entry time and improving continuity of care. However, this ability to leverage previous documentation doesn't come without risks. It's imperative that the user assumes the responsibility for updating the information to reflect the patient's current condition. And we still struggle to get sharable, comparable data out of those systems to inform outcomes.

As knowledge workers, nurses must leverage clinical data from the EHR to:

- optimize workflow and support clinical decision making
- tell the patient's story
- collaborate to foster knowledge translation
- leverage analytics to extract actionable knowledge
- use sharable, comparable data
- build evidence out of nursing practice.

However, in spite of our best collective efforts, and after decades of implementing EHR systems, nurses still can't consistently use big data for research or reporting quality and patient safety outcomes. We must guide consistent documentation and data collection to support big data research for transforming healthcare. To advance the vision of a transformed health system, we need a more coordinated structure in which information can be easily and safely shared among patients, consumers, clinicians, and providers to enable improved outcomes, quality of care, and lower costs. This vision requires access to real-time, accurate, and actionable health information. (See *Nurses enabling big data*.)

Preparing for the big data future

Today, EHRs aren't the only source of big data. Increasingly, medical data are being generated by patients and processed by computers. Using wearable wireless sensors, you can use your smartphone to generate your own medical data, including measuring blood oxygen and glucose levels, BP, and heart rhythm. Sophisticated medical imaging devices are being miniaturized to replace the stethoscope.[7] Patient-generated data are also flowing into traditional EHRs. Are we ready for this tsunami of new data? When that flood of data is properly assembled, integrated, and analyzed, it will offer huge new potential at two levels: the individual and the population as a whole. After all of 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.

This iterative flow of personal data will also require changes in the mindsets of healthcare stakeholders. For example, patients, consumers, and clinicians must be willing and able to trust and learn from person-generated data; this is a personal evolution as much as an analytical one. The potential value that

can be gained from these innovative technologies is great, but the necessary behavior change to depart from traditional practices will be challenging for both individuals and professionals.[4]

Evolving to a learning healthcare system

An important consideration in evaluating the benefits of big data is the ability to use it for research and education. According to the IOM, a learning healthcare system "is designed to generate and apply the best evidence for the collaborative healthcare choices of each patient and provider; to drive the process of discovery as a natural outgrowth of patient care; and to ensure innovation, quality, safety and value in healthcare. Advances in computing, information science, and connectivity can improve patient-clinician communication, 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."[8]

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.[9] And nurses are an essential part of this evolution.

Ultimately, when we realize this transformed healthcare system:

- Our focus is on patient satisfaction, patient safety, health promotion, and quality of care.
- The healthcare experience is personalized.
- Consumers are engaged in their health and healthcare with their care team.
- Evidence-based care improves outcomes and promotes health.

How can nurses leverage big data?

The ability for nurses to make optimal clinical decisions 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 EHRs, and alignment of 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 is hampered due to inconsistent use of data standards and terminologies. Cross-system

Nurses enabling big data: Outcomes of the 2014 Nursing Knowledge Big Data & Science for Transforming Health Care Conference

One of the more memorable events I attended was the 2014 Nursing Knowledge: Big Data & Science for Transforming Health Care Conference, hosted by the University of Minnesota School of Nursing. This conference brought together more than 70 stakeholders from nursing practice; education; information technology; and organizations that represent professional nursing, informatics, and standards. And it had a lofty goal: Advance a national plan for capturing nursing information for big data research aimed at identifying effective care interventions and improving patient outcomes.

This second annual Nursing Knowledge Conference focused on the transformation of nursing practice, research, and education. As described in the conference proceedings, we're in an era of big data; large databases of health information are being amassed within EHR systems and related repositories making them available for analysis to ascertain patterns, trends, and evidence that will guide patient care.[6] However, for research to accurately reflect all factors influencing patient outcomes, the data must include nursing information, as well as medical and other interprofessional evidence. The Nursing Knowledge Conference aimed to develop and foster implementation of a plan to ensure that nursing information is captured and integrate the concepts and application of big data into nursing practice, research, and education through collaboration.

Participants shared recent efforts to integrate nursing information into EHR systems; implement standardized language to represent nursing diagnoses, interventions, and outcomes of care; modify and standardize nursing informatics education to build understanding and competencies; and influence policy and standards for documenting and coding nursing information in healthcare knowledge systems. Three panels were featured: advancing nursing information in EHRs in practice settings, ensuring that quality e-measures focus on nursing care and are included in interprofessional national and international standards, and using sharable and comparable nursing data in research and quality improvement.

The commitment of each attendee to advance these efforts in addition to his or her "day job" is commendable. From educators and policy makers to executives from vendor and provider organizations, each participant was engaged and pledged to do his or her part to move the effort forward. Nurses are collaborative by nature and dedicated to making a difference for patients. And every conversation during the proceedings was focused on that goal. At the end of the proceedings, I felt confident that we'll make huge strides toward the transformation of nursing practice, research, and education to improve patient outcomes. Plans are underway for the 2015 Nursing Knowledge Conference, which will be focused on advancing an action plan to create sharable, comparable nursing data that's integrated into the EHR.

interoperability is limited, which results in the lack of comparability and consistency of nursing data.[10] 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.

To guide the ability to capture and use big data in nursing, the Healthcare Information and Management Systems Society CNO-CNIO Vendor Roundtable Big Data Principles Workgroup has identified the following recommendations.[3]

Promote standards and interoperability

1. Nurses should promote the use of standardized and accepted terminologies that address the documentation needs of the entire care team regardless of care setting. All care delivery settings should create a plan for implementing an American Nurses Association (ANA) recognized nursing terminology that's mapped to national standards, such as Systematized Nomenclature of Medicine—Clinical Terms (also known as SNOMED CT) or Logical Observation Identifiers Names and Codes (also known as LOINC).

2. Nurses should recommend consistent use of research-based assessment scales and instruments that are standardized through an international consensus body. The lack of standardization makes comparison of data challenging and adds to the burden of cost for copyright permissions and/or licensing of such instruments.

3. The ANA-recognized nursing terminologies should be consistently updated and made available to international standards organizations for translation and complete, comprehensive mapping.

4. Consistent use of discrete data elements in support of research, analytics, and knowledge generation is necessary, thereby minimizing the use of free text and "within defined limits" documentation.

Advance quality eMeasures

Measurement of quality data, including meaningful use clinical quality measures and nursing-sensitive performance indicators, is a complex process. The data needed to populate these measures come from multiple sources, some of which aren't currently available in the EHR. Therefore, alignment of the data to be collected, how they're collected, and the terminologies needed to support the data are critical to the ability to share data across settings and organizations. Clinical quality eMeasures are integral to these efforts and, as they evolve, will become essential for enabling analytics and big data initiatives to generate new evidence and knowledge.

Big data principles for quality eMeasures include the following recommendations.

5. Efforts to develop and design quality eMeasures must ensure that the data to be collected and measured are aligned with the clinician's workflow, not as additional documentation.

6. To advance nursing-sensitive quality eMeasures, paper measure sets must be evaluated for appropriateness and expectations set for which data should be collected, how the data are collected, and the required terminologies to be used.

7. Initiatives and programs that define and promote new quality eMeasures and their requirements should allow time for testing and piloting with defined timeframes that consider all stakeholders.

8. Clinical quality eMeasures must support evidence-based, cost-effective care that follows clinical practice guidelines and minimizes the negative impact on clinicians' workflow.

Leverage nursing informatics experts

Nursing informatics is a specialty that integrates nursing science with information management and analytical sciences to identify, define, manage, and communicate data, information, knowledge, and wisdom in nursing practice.[11] Informatics nurses support the entire healthcare team by applying their knowledge of information structures, information processes, information technology, and analytics. This application of nursing informatics knowledge is essential to enable the capture of health and care data in a structured way to accomplish the vision of accurate, reliable, clinically meaningful measurement across systems and settings of care.

Big data principles for nursing informatics include the following recommendations.

9. Healthcare organizations should utilize nurse informaticists to provide valuable insight into concept representation, design, implementation, and optimization of health information technology to support evidence-based practice, research, and education.

10. To achieve the desired outcomes, nurse informaticists should have formal informatics training, education, and certification.

Get ready for new knowledge

Big data is being collected through documentation, registries, EHRs, and devices throughout the continuum of care: at home and in the hospital, long-term-care settings, and public health environments. We must be assured that these data are

available to identify patterns and trends, and gather evidence that will, in turn, influence patient outcomes. The data must reflect nursing, medical, and other healthcare professional information and knowledge. The use of big data offers tremendous opportunity to accelerate the growth and synthesis of new knowledge to make a positive impact on nurses and the individuals and populations we serve.

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. We must leverage our collective resources to move nursing into the future by working together to advance progress and realize the promise of big data. NM

REFERENCES

1. Austin S. Stay out of court with proper documentation. *Nursing.* 2011;41(4):24-29.
2. Office of the National Coordinator for Health Information Technology. Health IT enabled quality improvement: a vision to achieve better health and health care. http://www.healthit.gov/sites/default/files/HITEnabledQualityImprovement-111214.pdf.
3. Healthcare Information and Management Systems Society. *Guiding Principles for Big Data in Nursing.* Chicago, IL: Healthcare Information and Management Systems Society; in press.
4. McKinsey Global Institute. Big data: the next frontier for innovation, competition, and productivity. http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation.
5. Institute of Medicine. Key capabilities of an electronic health record system. https://www.iom.edu/Reports/2003/Key-Capabilities-of-an-Electronic-Health-Record-System.aspx.
6. University of Minnesota School of Nursing. Nursing knowledge conference proceedings. http://www.nursing.umn.edu/prod/groups/nurs/@pub/@nurs/documents/content/nurs_content_482402.pdf.
7. Topol EJ. Your smartphone will see you now. http://online.wsj.com/public/resources/documents/print/WSJ_-C001-20150110.pdf.
8. Institute of Medicine. *Best Care at Lower Cost: The Path to Continuously Learning Heath Care in America*. Washington, DC: The National Academies Press; 2012.
9. Office of the National Coordinator for Health Information Technology. Federal health IT strategic plan 2015-2020. http://www.healthit.gov/sites/default/files/federal-healthIT-strategic-plan-2014.pdf.
10. McCormick KA, Sensmeier J, Dykes PC, et al. Exemplars for advancing standardized terminology in nursing to achieve sharable, comparable quality data based upon evidence. *Online Journal of Nursing Informatics.* In press.
11. American Nurses Association. *Nursing Informatics: Scope and Standards of Practice.* 2nd ed. Silver Spring, MD: American Nurses Association; 2015.

Joyce Sensmeier is the vice president of Informatics at the Healthcare Information and Management Systems Society in Chicago, Ill., and a *Nursing Management* editorial board member.

The author and planners have disclosed no potential conflicts of interest, financial or otherwise.

DOI-10.1097/01.NUMA.0000462365.53035.7d