The Promise of Data-Driven Care

J. Steven Cline

The growing adoption of electronic medical records and advances in health information technology are fueling an explosion of new health data. Expectations are high that new data resources will guide the transformation of the health care industry and positively influence population health. There have been challenges and opportunities at every turn, and progress has been slow, but mounting evidence suggests that better use of data is moving health care in the right direction.

The considerable attention being paid to advances in health information technology (HIT) and health care reform suggest that the United States is in the midst of a health care revolution. Economic incentives offered by the Centers for Medicare & Medicaid Services (CMS) have resulted in huge increases in the adoption of electronic medical record (EMR) systems; the percentage of physicians with EMR systems that allow them to record notes in patient records increased from 44% to 73% between 2009 and 2012 [1]. Similarly, health insurance and payment reforms are forcing a shift from fee-for-service, volume-based care to outcomes-based, value-driven care; in the latter paradigm, care is often provided by patient-centered medical homes (PCMHs) or accountable care organizations (ACOs), potentially using payment arrangements such as shared savings programs or bundled payments. These new models of care are driving the need for new data systems, and public demand for transparency and consumer engagement are also growing rapidly. Together these changes have the potential to rapidly and dramatically transform the health care system. Although some of these HIT concepts may seem radical, real-world implementation has been lengthy and often painful, and the transformation is actually more evolutionary than revolutionary.

Although this transformation is not yet complete, we already have more data, more types of data, and greater access to data than we have ever had before. How is this "big data" environment changing health care? Are we using data to help us chart the best course for change? Is our use of data making patients healthier, reducing the cost of care, and improving patients' experience in the health care system [2]? How is the health care industry using HIT and newly developed data capacities to reshape and improve the health care system in North Carolina? These are the questions addressed by the distinguished group of authors, health care providers, and data analytics experts who contributed to this issue of the NCMJ.

Background

Although health care reform is a political hot potato, the need to make fundamental changes in our health care delivery system is undeniable. This is particularly true with regard to data. The health care system needs better data so that we can understand what needs to change, and so that we can evaluate the success of changes that are currently in progress. Technology is already an integral part of virtually every aspect of our lives, and health care can no longer afford to lag behind. Emerging concepts such as big data, informatics, data visualization, health information exchanges (HIEs), telehealth, and mobile health are now mainstream thinking in HIT, and the public eye is upon us. Our educational institutions and training programs are producing a new generation of health care professionals who grew up with information technology and expect to use it in their workplaces. Users' appetite for HIT and the public's acceptance of it are also improving significantly as health care applications grow, multiply, and mature.

Ironically, much of the information technology currently being deployed in health care is not new. Other industries—such as banking, insurance, entertainment, and even grocery stores—have built innovative ways of collecting and using existing data that create value for their individual businesses and their industry. For example, the online retailer Amazon.com has such large and sophisticated data resources that the company can tweak the font used in an online consumer offer and measure the effect of that change within minutes [3].

Many trends are converging to move HIT forward, but one of the most important is the concept of meaningful use. CMS's federally funded Electronic Health Record Incentive Program provides financial payments to eligible Medicare and Medicaid providers (physicians and hospitals) who meet meaningful use requirements by demonstrating that they use certified EMR systems effectively. Core objectives for eligible providers in the program [4] are listed in Table

TABLE 1.

Objectives for Stage 2 Meaningful Use for Eligible Professionals Participating in the Electronic Health Record (EHR) Incentive Program of the Centers for Medicare & Medicaid Services

Core objectives

1. Use computerized provider order entry for medication, laboratory, and radiology orders directly entered by any licensed health care professional who can enter orders into the medical record per state, local, and professional guidelines.

2. Generate and transmit permissible prescriptions electronically.

3. Record the following demographic information: preferred language, sex, race, ethnicity, and date of birth.

4. Record and chart changes in height/length and weight (no age limit) and blood pressure (for patients aged 3 years or older); calculate and display body mass index (BMI); and plot and display growth charts, including BMI, for patients aged 0–20 years.

5. Record smoking status for patients aged 13 years or older.

6. Use clinical decision support to improve performance in treating high-priority health conditions.

7. Provide patients the ability to view online, download, and transmit their health information within 4 business days of the information being made available to the eligible health professional.

8. Provide clinical summaries for patients for each office visit.

9. Protect electronic health information created or maintained by the certified EHR technology through the implementation of appropriate technical capabilities.

10. Incorporate clinical lab-test results into the certified EHR technology as structured data.

11. Generate lists of patients by specific conditions to use for quality improvement, reduction of disparities, research, and outreach.

12. Use clinically relevant information to identify patients who should receive reminders for preventive or follow-up care and send these patients the reminders, per patient preference.

13. Use clinically relevant information from the certified EHR technology to identify patient-specific education resources and provide those resources to the patient.

14. The eligible professional who receives a patient from another setting of care or provider of care or believes an encounter is relevant should perform medication reconciliation.

15. The eligible professional who transitions a patient to another setting of care or provider of care or refers a patient to another provider of care should provide a summary care record for each transition of care or referral.

16. Have the capability to submit electronic data to immunization registries or immunization information systems, except where prohibited, and in accordance with applicable law and practice.

17. Use secure electronic messaging to communicate with patients regarding relevant health information.

Menu objectives

1. Have the capability to submit electronic syndromic surveillance data to public health agencies, except where prohibited, and in accordance with applicable law and practice.

2. Record electronic notes in patient records.

3. Have the capability to access imaging results, consisting of the image itself and any explanation or other accompanying information, through the certified EHR technology.

4. Record patient family health history as structured data.

5. Have the capability to identify and report cancer cases to a public health central cancer registry, except where prohibited, and in accordance with applicable law and practice.

6. Have the capability to identify and report specific cases to a specialized registry other than a cancer registry, except where prohibited, and in accordance with applicable law and practice.

Source: Adapted from information on the Centers for Medicare & Medicaid Services Web site [4].

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1. This incentive program is driving EMR adoption, setting standards for EMR application development, and making clinical information digital and sharable. Technology-enabled EMR systems, meaningful use requirements, payment reform, market transparency, and consumer choice are rapidly changing the rules of the game. As Helm-Murtagh states in her commentary in this issue, "The pressure to reduce costs and improve outcomes is ... generating new models of care and payment ... which require the integration and analysis of clinical and financial data" [5]. In the reformed health care marketplace, successful health care organizations must embrace new technology and be able to use their data wisely to create value for their business and their customers.

Big Data

A great deal has been said about "big data," which has been described as high-volume, complex, unstructured bits of digital information that can be mined for relevant content. As Duke University psychologist Dan Ariely observed, "Big data is like teenage sex: everyone talks about it, nobody really knows how to do it, everyone thinks everyone else is doing it, so everyone claims they are doing it" [6]. Use of big data in health care is poorly defined, and wild promises have been made about what it can deliver, but in my view big data is not where we should be focusing our first efforts in the quest to remake our health care system. As Groves and colleagues have noted [7], "The big-data revolution is in its

early days, and most of the potential for value creation is still unclaimed."

That said, this issue of the NCMJ includes excellent examples of North Carolina providers who are embracing the notion of using large-scale databases to better understand their businesses. Community Care of North Carolina (CCNC) has a large database of Medicaid claims, pharmacy information, and other data from its 14 care networks statewide, and it uses these data to "intelligently [target] the subpopulation of patients who are most likely to benefit from care management support" [8]. Algorithms and predictive modeling enable CCNC to proactively identify the patients on whom care management intervention will have the greatest impact and to rapidly communicate that information to providers. Doing so has improved the health of the patients served by CCNC networks and has saved millions of dollars for the state's Medicaid program.

The research and pharmaceutical industries have long depended on data for product development and safety. The introduction of new technology, the ability to easily add more real-time clinical data, the growth in networks of providers, and the addition of patient-generated information will only increase the usefulness of such data. In a commentary in the current issue, Menius and Rousculp point out that "to support the approval of new medicines, the pharmaceutical industry has conducted thousands of clinical studies, resulting in data that can be reanalyzed to compare the outcomes of different treatments or to identify patient subgroups with varying efficacy or safety profiles" [9]. Other sectors of the health care industry are just beginning to learn how powerful data analytics may prove to be.

Big data is an attempt to make sense of diverse health and behavioral observations by connecting seemingly unrelated events to outcomes. Some HIT experts believe that the speed of data gathering and the variety of data sources included in an analysis are more important than the volume of data. Others have obtained positive results by slicing and dicing huge historical data sets using new questions and new analytic techniques. One thing we know for certain is that the adoption of EMRs, the use of clinical HIEs, success in mapping complex genetic sequences, and the use of electronic disease registries mean that the amount of health data now being generated on a daily basis is staggering, and it will continue to grow exponentially. According to Eric Schmidt, chief executive officer of Google, "the world creates 5 exabytes of data every two days. That is roughly the same amount created between the dawn of civilization and 2003" [3].

Connected Health

Developing the concept of *connected health* is perhaps even more important than amassing huge databases of newly available health information. How can we take the information that already exists in patient charts, observations by members of the health care team, and knowledge about patients' lives and use that information to make better and timelier health care decisions? The answer is that we must do a better job of securely and appropriately sharing existing information among multiple providers and patients. HIT and HIEs enable providers to use this information to make better decisions at the point of care, when they can have the greatest impact on the patient's health. These are not elaborate new insights into new data or complex algorithms using advanced analytics; rather they are existing bits of personal health information that can be shared among members of the patient's care team. For example, clinicians can provide significantly improved care if they know which medications have been prescribed for the patient, their potential adverse effects, whether the patient has been filling the prescriptions on time, and when and why the patient has been hospitalized; clinicians can also benefit from having faster and easier access to results of all laboratory tests performed for the patient, including those ordered by other providers in the same or other facilities.

In this issue, James describes how one North Carolina accountable care organization is using low-tech approaches to transmit data and drive change [10]. HIT is making connections easier and is expanding the scope of relevant information that the provider has at hand when making treatment decisions. HIT is making it possible to collect, validate, and integrate more data about how a patient lives, and these data have direct implications for the patient's care and health. In another commentary, Dayton describes how new technology is being deployed by the North Carolina Immunization Registry to create a bidirectional electronic interface that will enable a provider's EMR system to communicate directly with the registry [11]. This connection will allow the provider to see a patient's complete vaccine history and to know which additional vaccines are recommended.

Patient Engagement

Consumer-mediated HIEs and patient-generated health information will ultimately play a significant role in the data systems currently under development. It has been firmly established that the majority of a person's health status is determined by the individual's lifestyle choices, his or her environment, and the level of family/community support available [12]. Thus it is increasingly important for health care providers to understand what happens to their patients outside the health care delivery setting. Providers and patients must work together in new ways, and technology can assist in this effort. Successful practices across North Carolina have adopted a PCMH approach to providing care for their patients. In their sidebar on quality improvement at Asheville Medicine and Pediatrics, Schau and Rokaw note that their objective for patients is that "they have an understanding of their care plan and of ways of collaboratively managing their health" [13]. A transformed health care system will rely on enhanced patient engagement to improve health.

New technologies are making it possible to gather and record information about the patient outside the office. Mobile health devices such as FitBit exercise bands (FitBit, Inc., San Francisco, California) and remote patient monitoring are growing in popularity, and these devices enable monitoring and quantitative data to be collected almost anywhere and anytime. Mobile disease management is an area in which personal health data is projected to grow rapidly. It is predicted that by the year 2018, 24 million people will use some sort of personal electronic diabetes management application, most likely on their smartphones [14]. As technology increasingly puts the patient in the center of the health information universe, trusted providers will gain unprecedented access to all aspects of a patient's life—family, environment, behaviors, and real-time health status.

Of course, this expanded sharing of personal health information will not happen if patients are not comfortable with the security of this information or if they do not agree with how it will be used on their behalf. In his commentary in this issue, Juengst explores the inherent conflict between privacy and transparency [15]. He makes the point that if we truly want to build a learning health system [16], we must address complex issues of trust, confidentiality, and patient participation. Also in this issue, Califf suggests that perhaps it is time to reexamine the division between clinical practice and research [17]. Should there be an expectation of patient involvement in research design and implementation, as well as an expectation to participate in data sharing?

The meaningful use standards for eligible providers and hospitals not only require that providers have technology that can engage patients—such as Web portals and electronic communications—but also require that patients actually use this technology. The meaningful use deadlines for meeting certain thresholds in patient engagement have been relaxed; however, the need to substantively engage the consumer will be crucial for success as we move forward. Soon consumers will demand transparency, choice, and control of their own personal health information. The assumption is that patients will be willing to share their information if they perceive that doing so will help them and if they believe that the system will protect their privacy and security.

Population Health Management

Population health management is another term that often comes up in discussions about health care reform. It is commonly used to describe a data-driven process for understanding a group of patients with a specific set of circumstances (eg, a certain disease) and deciding how best to manage their health in a value-based reimbursement system. The term "population health management" can be confusing because it means different things to different people, depending on what goal they hope to achieve with the data.

Governmental public health is founded on principles of population health management. Public health professionals have long tracked specific conditions across a broad population base over time in order to identify trends or threats and then determine actions to improve the health status of the affected population. In this issue, Bruckner and Barr make the case that population health is now an essential part of health care, and they provide examples of how a local public health department partnered with community hospitals to identify patients with diabetes and to lower the burden of disease using community-based services [18].

Identifying patients with diabetes who might benefit from community-based services might be considered population health surveillance, but population health management in the context of the current health care reform movement is more focused on "active" population health management—the ability to effect change using the data obtained by such surveillance. HIT experts describe 2 types of population health management that are emerging in the new, better-integrated health care market: care management and performance management. The difference between the 2 is that the users of the data have different goals. In care management, data is used by providers, care coordinators, and patients to better manage a patient's health risk. In performance management, the users are health care administrators, chief medical officers, and chief technology officers who are using data to improve the care delivery process [19]. Both purposes are valid, and those involved in care management and performance management often rely on the same or overlapping data sources. However, they use different applications and analytics to answer their questions, and the lack of coordination between the 2 user groups, often in the same organization, is a potential problem.

As James observes in his commentary [10]:

> To achieve the ACO ideals of population health and to become truly accountable for cost, quality, and the experience of patients, we must identify, implement, mine, and analyze data in a new way. Data must now encompass a much broader representation of the continuum of care than was previously possible in the American health care system, which has traditionally been extremely fragmented.

Peters and colleagues explain in their commentary [20] that one of the most effective tools for improving population health management is an all-payer claims database (APCD). An APCD allows health policy professionals and decision makers to better understand health care utilization and costs across a broad range of populations. Many states are building APCDs in response to the need for comprehensive, multipayer data, which is required by health care reform and the new models of care. APCDs typically include data derived from medical claims, pharmacy claims, eligibility files, provider files, and dental claims from both private and public payers. The majority of APCDs are built under the strength of a state mandate. There are currently 14 states with existing APCD systems and 26 states with APCDs in various stages of development [18]. North

Carolina is one of only 10 states that do not currently have plans for an APCD.

Conclusion

An examination of the current state of data-driven care in North Carolina can lead to several conclusions. First, we face the problem of data overload—the new HIT environment is producing more data than the health care industry is prepared to deal with at this point. Specific examples of best practices exist, but they are often born out of a specific need and use only a subset of data capacity. As HIT matures and evolves further, the life cycle of health care decisions will become shorter as dramatic improvements occur in the time it takes to move through the information continuum—from multiple data points from a variety of sources, to useful information, to enhanced data analytics, to clinical insights, and ultimately to the best decisions made in the right places at the right time.

Second, most health care providers would benefit from making better use of the data they already have to improve outcomes. The focus should be on building connections with members of the care team and with patients rather than relying too much on elaborate new technologies. HIT is necessary for the successful practices of the future, but it will take time for it to develop and become a part of the provider work flow.

In addition to technology, much of our ability to create healthy outcomes in an accountable health care delivery system will depend on our ability to engage patients. Few things are more important to the effective delivery of health care services than a relationship between patients and providers that is built on a strong foundation of trust. As we take advantage of all of the new technology that enables us to collect and share information about our lives and our health, we must make sure that we do not lose the patient's trust. This means that the right legal and social framework must be in place to protect the patient and to allow for appropriate sharing.

Finally, it is time for North Carolina to seriously explore building an APCD. North Carolina is well positioned for transformation of its health care delivery system. The state is endowed with smart, committed providers; nationally recognized health care institutions; leading academic medical centers and professional training programs; a strong public health infrastructure; and industry leaders in technology, pharmaceuticals, and health research. We have all of the necessary components, but our success will depend on how well we work together and learn from one another as we create the health care system the citizens of North Carolina deserve. NCMJ

J. Steven Cline, DDS, MPH vice president for strategic partnerships, Community Care of North Carolina, Raleigh, North Carolina.

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