

Information technology and the medical profession: a curse or an opportunity?

WYNNE M. SNOOTS, MD

Physicians have seen the computerization of health care in our lifetimes. Undoubtedly, computers and other medical technology have improved the quality of health care tremendously. However, some aspects of this computerization have been stumbling blocks rather than aids to physicians and their patients. In this article, I describe some of the “curses” that have resulted from the codification of health care. I also describe an information system developed for the orthopaedic surgeons at Baylor University Medical Center (BUMC) that seeks to correct some of the limitations of administrative data and offers an opportunity to improve patient care and our individual practices.

This story is a personal one. Before I went to medical school, I used my English and engineering degree to sell computer systems for IBM. Back in the 1950s, the systems were basically punch card applications, although soon afterward tape-based systems and sequential processing were developed. In my sales pitch, I stressed how, for the first time, data could be entered once, verified, and then never entered again. The computer systems were so expensive that only the largest companies could afford to rent the equipment (the equipment was never sold in those days).

After a stint in the US Army, I attended medical school. As a young physician in the late 1960s, I entered notes on my bills such as “fractured tibia and fracture care.” All diagnoses and procedures were described verbally.

Around this time, however, insurers began requiring standardized codes instead of descriptive language on billing information. The first codification system was the Bertillon Classification, or International List of Causes of Death, developed before the turn of the 20th century. It subsequently became known as the International Classification of Diseases (ICD). The World Health Organization updates this list, which is now in its 10th edition. The volume listing the codes is well over 1000 pages long.

The American Medical Association published Current Procedural Terminology (CPT) in 1966, drawing on the input of its physician members. The codes are derived from medical specialty nomenclatures. In 1983, the Health Care Financing Administration (HCFA) adopted the CPT code for its Common Procedure Coding System. The fifth edition of CPT codes should be released in fall 2002.

HCFA became frustrated with the large number of ICD and CPT codes and developed a limited lexicon of 432 diagnostic-related groups (DRGs) to facilitate reimbursement and case-mix analysis for hospital providers. The number of DRG codes was

subsequently expanded. These codes in particular lack the specificity to be of value in clinical research or patient care. Physicians are severely limited in their ability to codify the procedures we do. An extensive process is required to develop a coding change for new procedures and innovative changes. The majority of procedures include a “global period and set of included services” that is automatically included in the “global” charge. Procedures are done on individual patients, however, and the individual variations—e.g., age, associated conditions, previous procedures, altered surgical site, and many others—are difficult, if not impossible, to codify in the limited lexicon. Complications, which are inherent in our profession, are viewed as inferring liability, and the result is underreporting. Complications should, rather, be acknowledged and considered an opportunity to find out what went wrong, allowing us to continue to improve care. The codes for “evaluation and management” services are thought by the profession to be so restrictive that, to date, the rules have not been finalized. Careful evaluation and management is the basis of our profession, in my opinion greatly undervalued, and probably impossible to codify and value except after the fact. How many business managers would tolerate being paid only after reducing their productivity to a limited number of 5-digit codes provided by a third party?

THE CURSE OF CURRENTLY AVAILABLE DATA AND THEIR USES

Many argue that consistent nomenclature and a lexicon of approved terms are essential. Even so, codification detracts from the richness of the medical vocabulary. The real problem is that limited but readily available administrative data, consisting of demographic characteristics plus codes for diagnoses and procedures, are used to assess the quality and cost-effectiveness of care. Governmental and private insurers compare the number of procedures done at different facilities and require a second opinion when the number falls below a certain threshold. They compare lengths of stay for similar codes and limit payment to the shorter number of days. Hospital report cards and physician profiles have been developed on the basis of this information alone. In addition, the data are flawed. Staff with differing degrees of experience enter data, which often are not verified after being entered.

From the Department of Orthopaedic Surgery, Baylor University Medical Center, Dallas, Texas.

Corresponding author: Wynne M. Snoots, MD, 3434 Swiss Avenue, Suite 104, Dallas, Texas 75204 (e-mail: snoots@bhcs.com).

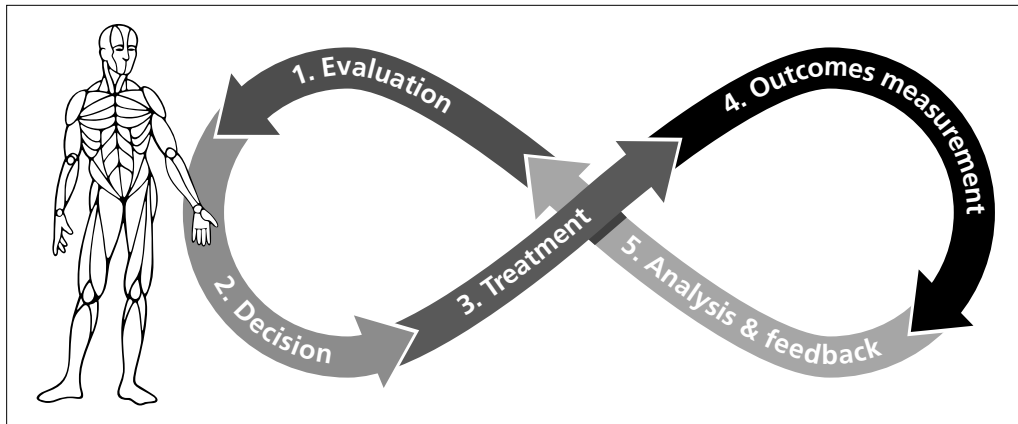


Figure. The 5 components of the orthopaedics information system. The loop continues after the fifth step as later patients rely on information drawn from prior patients and the data fields themselves become more complete so that the users can get more out of the system.

Lack of physician documentation (which is often redundant from our perspective) impairs the codification process. Administrative data do not address severity; they do not address regional variations in populations and procedures, processes of care, timing, or appropriateness.

This misuse of administrative data negatively affects physicians and other health care providers by impairing payment for services and positioning us in a reactive mode. It emphasizes the commodity aspects of health care, encourages procedure specialization, de-emphasizes the importance of individual case management, and emphasizes collective costs or savings. Consumer confidence has been undermined as collective administrative needs have overpowered individual medical needs.

Physicians have recognized the importance of adding more data before asking questions about quality and cost-effectiveness. They want data that follow the patient for the long term rather than focusing on the episodes of care captured by billing information. They want data that show temporal relationships and account for patient and physician variation. They want data that are verified and consistently codified and a lexicon that adequately expresses the realities of clinical practice.

The basic problem is that physicians tend to work in isolation. While government, hospitals, and insurers have access to administrative data and the resources to create information systems to satisfy their needs, physicians lack such resources.

THE ORTHOPAEDIC INFORMATION SYSTEM AT BUMC: AN OPPORTUNITY

In 1996, orthopaedic surgeons at BUMC partnered with Baylor Health Care System to develop a patient-centric, longitudinal database that had the right mix of data to answer health care questions from the perspectives of both patient and provider. The partnership occurred after surgeons agreed to use fewer vendors for joint replacement products to bring cost savings to the system, provided a portion of that savings was used as initial funding for this project. An outside consultant was hired to design the system, which is expected to be an evolutionary process.

Technological advances converged to make such a system possible. The Internet allows access to a variety of applications with different operating systems. Processing speed is very high, and economical mass storage is available.

The system will initially track orthopaedic procedures that are common and have a significant economic impact: total hip and knee replacements, surgical spine procedures, arthroscopic surgery of the knee and shoulder, and carpal tunnel surgery.

The initial goals of the system are to forge information technology tools using standard components (open architecture) to accomplish the following:

1. Create a patient-centric database using administrative data already recorded but currently organized by episodes of care
2. Improve the codification process by facilitating direct physician involvement
3. Document the clinical decision-making process by including clinical data elements
4. Eliminate the repeated entry of data
5. Verify data, enabling physicians to trust it
6. Manipulate this collection of data, which combines financial and clinical data, to enhance analysis
7. Present the data using Web technology to enable physicians to compare their outcomes with those of their peers (terms like "best practice," "value added," and "quality" will have a more scientific basis and provide an opportunity for meaningful changes in clinical care processes)
8. Share the data and improve communication and trust among physicians, patients, hospitals, the community, and payers

The system follows the patient sequentially through 5 steps (Figure).

1. *Evaluation.* In the evaluation phase, information is gathered from the patient and the surgeon about the patient's health status and history. With this information, the problem is defined and treatment is determined. The surgeon completes the office data form; the patient fills out a health history survey to gather medical history information and an initial functional status survey. Once the demographic information is in the system, it does not have to be reentered. Unfortunately, key demographic information is repeated for each episode of care in administrative databases!

2. *Decision.* After a treatment decision is made, more specific information is gathered. The patient goes to "joint school," where a physical therapist records range of motion measurements and

the functional independence measure. Data are also extracted from hospital administrative systems.

3. *Treatment.* During the hospital stay, financial data from the hospital administrative system are collected, and clinical data such as postoperative range of motion measurements are recorded. Physician and hospital codes for diagnoses and procedures are coordinated and verified in real time.

4. *Follow-up and outcomes measurement.* The system notes the conditions of the patient's discharge, i.e., whether he or she proceeds to a skilled nursing facility, a rehabilitation center, restorative care, or home with or without additional outpatient care. Any administrative data from rehabilitation or home health care, if available, are entered into the system, as are data from the patient's postoperative visit. A follow-up functional status survey is mailed to the patient; results of this survey are entered into the system.

5. *Analysis and feedback.* The system uses a relational database allowing users flexibility in making queries. Users can analyze procedure-specific data and gain a better picture of how the procedure affected the patient. Knowledge gained can answer questions about the appropriateness and quality of the procedure and about patient outcomes. Surgeons can improve their care, and patients and payers can rely on information from the system to make decisions.

The information system serves to identify and document key data elements, storing them in a data repository specific to the practice of orthopaedic surgery. It plays a role in meeting several of Baylor Health Care System's strategic objectives. It "connects consumers, clinicians, and other stakeholders" (objective #3) since all participate in data entry and analysis and the system facilitates communication among them. It supports the best care objective (#4) by allowing assessments of quality and facilitating quality improvement efforts. Finally, it supports the re-

search objective (#9) since it provides data required for clinical studies and provides answers to the initial queries that are the basis of good clinical research.

WHERE ARE WE NOW?

Our database includes information on all patients treated by orthopaedic surgeons at BUMC since July 1996. The various episodes of care are accessible in a longitudinal array. Data from Baylor Institute for Rehabilitation will be added soon. The codification process has been improved by having a "concurrent coder" on the orthopaedic floor, allowing better physician involvement in the coding process. Real-time codification of the diagnosis and procedure in the operating room will be available this year. Clinical data elements for total hip and knee replacements, including preoperative and postoperative functional status, have been collected for the past 2 years. Data verification is becoming more of a priority. Data aggregation, manipulation, and query by skillful utilization of standard software has, for the first time since I completed my medical training, allowed me to compare my "outcomes" (both clinical and resource utilization) with those of my peers. The usefulness of the technology is facilitated by Internet access. Hospital administrators have access to a clearer picture of the physician perspective.

CONCLUSION

Raw data in themselves are not particularly useful. They must be turned into information, which ultimately becomes knowledge and finally wisdom. However, the value of the information depends on the accuracy and completeness of the original data. With this system, Baylor Health Care System and the orthopaedic surgeons who practice there have attempted to gather the data that can improve health care.

Invited commentaries

Can you imagine going into a bank today with a stack of checks and cash to deposit and having the teller record each check by hand with pencil and paper, count the cash, total it by hand, and then record your deposit in your pass-book?

Can you imagine going into a grocery store today, pulling up to the checkout counter with your cart overflowing with groceries, and having the clerk write down the price of each item on a piece of paper, adding it up by hand, and then presenting you with your bill?

Now can you imagine going into a doctor's office today and having the doctor ask you some questions while writing your answers on a piece of scratch paper and then dictating your record at the end of the day? The dictation is then transcribed, printed, and stored in a loose-leaf file with 3 years worth of records on other patients, to be pulled by hand the next time you return.

These scenarios illustrate where the medical industry is in computerization compared with the rest of the world. Medicine has gone about computerization backwards. We have developed billing systems and then tried to hang electronic medical records on them rather than developing a computerized medical record system and hanging a billing system on it. After all, any procedure, including an office visit, generates a CPT code, and one bills from CPT codes. The first hospital systems were "order entry/charge capture." The first computerized office systems were billing systems because that is what paid for the computer.

But we are not capturing data that let us assess how we are affecting our patients. Very few physicians, outside of academic centers where there are residents, collect outcomes data. Physicians in private practice find it too time consuming. Hospitals are beginning to develop computerized medical record systems, but in this day of outpatient surgery and shorter hospital stays,

the nonintegrated hospital systems have trouble capturing data on the patients after they have been discharged. In addition, hospital electronic medical record systems rarely include outcomes data.

I would agree with Dr. Snoots that it is unfortunate that we cannot develop a system that allows us to include the rich descriptive language used by physicians to describe the multiple variations of conditions we see; however, unfortunately, I do not see a way around this problem. One of the problems in the past was that we were not using standard terms to describe diagnoses or procedures and thus were unable to compare much of anything across physicians or centers. Even the American Medical Association's Current Procedural Terminology (CPT) contains inconsistencies. For instance, code 63030 is not a laminectomy, as stated in the descriptor, but instead a laminotomy with a disc excision. Usually no lamina is removed at all. And a study by Fardon demonstrated that we are not even consistent in our spelling of the word *disc* (disk) (1). CPT is attempting to correct its inconsistencies by requiring use of the preferred term in the *Metathesaurus* of the National Library of Medicine.

Because of spelling and terminology inconsistencies, searching text is inefficient and thus far has not been successful. As Dr. Snoots points out, the alternative is to develop a computerized medical record. Several "systems" are being touted, but many of them are merely word processing systems that store text electronically. Although these systems allow access of the record from remote locations, the problems associated with assessing outcomes by having to search text persist. The solution seems to be to collect and store coded data. That way the computer captures and stores characters that represent blocks of text rather than the full text. For example, rather than dictating, "The patient has a 3+ effusion of the left knee" the physician would input a "3" in a left knee effusion field. That way the computer would store only the "3" character. A word processing system can easily generate the appropriate text for a paper record if necessary or for reports to attorneys, insurance companies, and other physicians, but what remains in the computer is that one character. This saves storage space, should reduce the time required of the physician to input the data, and allows an efficient search of all patients with a 3+ effusion of the left knee.

The problem has always been the difficulty in getting the data into the computer. Many different methods have been tried, including scanning, direct input by the physician or his or her

Dr. Snoots offers a personal view on a unique project designed to capture and aggregate information about an orthopaedic patient across the continuum of health services and over an extended period of time. As chief information officer, I have been a cheerleader and advocate, encouraging Dr. Snoots and members of the design and product development team to continue to do the difficult tasks of pioneering required by a first-generation computer system, while working with administrative management to provide oversight and funding for the project. The support of administrators in the funding of a project like the orthopaedic information system (OIS) is rare among community hospitals. It is a clear example of Baylor Health Care

staff, voice recognition, and use of templates. None has been universally accepted because of the extra time required of the physician, staff, and/or patient. The system most desired by the physician is voice recognition because physicians do not want to give up their Dictaphones. However, thus far voice recognition has not been accurate enough to alleviate the need to review each dictation, and this has eliminated the savings that we expect from an accurate voice recognition system. The solution may be the combination of the voice recognition and the coded data, because inputting coded data will require a slower, staccato type of speech, more easily recognized by the voice recognition software.

The implementation of the Health Insurance Portability and Accountability Act and the effort to correct medical errors will drive us toward an electronic medical record both in the hospital and in the physician office. Change is usually painful, and it will be this time for many physicians. But it is coming, nonetheless. Merely adding a computer to the system only complicates the process and adds at least one more step to the system. The entire system must be re-engineered to eliminate steps that do not add value and achieve efficiency. The only step that adds value to the medical record system is the documentation of the visit or procedure. This will require point-of-service data collection, which in most cases means input by the physician. As painful as this may sound, the sooner we get at it, the sooner we will be able to give more than lip service to the term "evidence-based medicine."

The 8 goals outlined by Dr. Snoots are right-on and address the requirements of a successful electronic medical record system. The 5 steps through which the patients are taken are efficient and allow for better medical care. I laud Dr. Snoots and the physicians at Baylor for implementing this system. The only project left is to coerce the rest of the physician community to do likewise. Good luck!

—R. H. HARALSON III, MB, MBA
Southeastern Orthopaedics, Knoxville, Tennessee
Chairman, Coding Committee,
American Academy of Orthopaedic Surgeons

-
1. Fardon DF, Milette PC. Nomenclature and classification of lumbar disc pathology. Recommendations of the Combined Task Forces of the North American Spine Society, American Society of Spine Radiology, and American Society of Neuroradiology. *Spine* 2001;26:E93-E113.

System's stewardship, investing in a system on behalf of the entire community.

Throughout the project life (1996 to present), I have been impressed with Dr. Snoots' commitment to doing the right things on behalf of the patient. Baylor Health Care System has adopted the 6 major aims of health care described in the 2001 Institute of Medicine Report, *Crossing the Quality Chasm: A New Health System for the 21st Century* (1). Dr. Snoots and the OIS are endorsements of these 6 major aims.

Safe—Avoiding injuries to patients from care that is intended to help them. At the heart of OIS is a patient-centric database designed to aggregate standardized data across a population of or-

thopaedic patients being treated for similar conditions by a community of orthopaedic physicians. Data are codified. Data fields are required to document the decision-making process followed by caregivers. By collecting these data over time and enabling physicians to compare outcomes, to quote the article, "Terms like 'best practice,' 'value-added,' and 'quality' will have a more scientific basis and provide an opportunity for meaningful changes in clinical care processes."

Timely—Reducing waits and sometimes harmful delays for both those who receive care and those who give care. A defined objective of OIS is to shorten time and distance for physicians through improved processes and automation. Information that was not available or was available only through a manual process of phone calls, personal interviews, professional courtesy, or personal perseverance is now being collected, codified, and verified and is readily available to participating physicians. The patient benefits because his or her information is online and available during evaluation, decision, treatment, and follow-up. The physician community benefits in each phase as well, as more and more patients are treated, outcomes are measured and evaluated, and analysis and feedback are available.

Effective—Providing services based on scientific knowledge to all who could benefit and refraining from providing services to those not likely to benefit. OIS is designed as a repository of clinical outcomes. By studying these data in a scientific way and "by allowing assessments of quality and facilitating quality improvement efforts," more effective treatments can be defined, documented, and monitored for compliance. Variances of treatments by physicians can be identified and tracked, outcomes studied, and treatment protocol results shared across the community of physicians.

Efficient—Avoiding waste, including waste of equipment, supplies, ideas, and energy. By making OIS Web-enabled, it is easy

to access, and barriers to adoption are minimal. A physician needs only a personal computer, Internet browser, Internet service provider, and valid password to have access to the system. Standards were developed, enforced, and managed to ensure minimal support requirements. Hassle factors including patient chart pulls, incomplete and nonstandard record keeping, and incomplete histories or demographic information are reduced.

Equitable—Providing care that does not vary in quality because of personal characteristics such as gender, ethnicity, geographic location, and socioeconomic status. Patients can be better monitored according to their personal characteristics with OIS. All key data fields are entered and coding is standardized to improve patient identification. Treatment protocols are associated based on diagnosis and procedures.

Patient-centered—Providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions. Above all, OIS is designed as a patient-centered database. Data are collected by patient, by episode, and by step. By aggregating data across patients with like diagnoses and like treatment, outcomes can be studied over time.

Baylor Information Systems applauds the commitment of the author and the system designer embodied in OIS. Their vision is to capture clinically relevant data designed to improve care and then use this information in the careful evaluation and management of the practice of orthopaedic medicine. My hope is that other physicians adopt OIS as a standard tool, contribute to the data, and share in the knowledge being created.

—ROBERT PICKTON, MBA
Chief Information Officer, Baylor Health Care System

-
1. Institute of Medicine. *Crossing the Quality Chasm: A New Health System for the 21st Century*. Washington, DC: National Academy Press, 2001.