Articles

Strategies and Methods for Aligning Current and Best Medical Practices

The Role of Information Technologies

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Rapid change in American medicine requires that physicians adjust established behaviors and acquire new skills. In this article, we address three questions: What do we know about how to change physicians' practices? How can physicians take advantage of new and evolving information technologies that are likely to have an impact on the future practice of medicine? and What strategic educational interventions will best enable physicians to show competencies in information management and readiness to change practice? We outline four guiding principles for incorporating information systems tools into both medical education and practice, and we make eight recommendations for the development of a new medical school curriculum. This curriculum will produce a future medical practitioner who is capable of using information technologies to systematically measure practice performance, appropriateness, and effectiveness while updating knowledge efficiently.

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Rapid change both inside and outside of American medicine is engendering a new set of demands on the physician, demands to change established behaviors and acquire new skills.[1] Patients and purchasers of care want more detailed levels of accountability for the price and quality of medical services. New payment mechanisms are implicitly defining constraints on resources for the care of most patients. Physicians are increasingly moving from independent and small-group practice into larger, progressively more organized delivery systems. The boundaries and uses of the hospital for patient care, education, and research are being redefined. All of these organizational changes are happening along with an explosive growth of specialized medical knowledge.

American medicine is also being asked to expand its concept of health care beyond the biomedical model of diagnosing and treating acute disease to a model that will include focusing on population health, distributing equitable and appropriate resources to populations, incorporating new measures of success in caring for chronic disease, assuming financial risk for the costs of care, and adopting new ways of managing health information. Traditionally, physicians have not been trained to consider financial risk for patient care, to account for the health of populations, to work in large groups, or to coordinate the services of other institutions such as home health care agencies. Even maintaining and building the traditional knowledge base of clinical medicine has become a daunting task for practitioners because of the growth of biomedical knowledge.

As clinicians adapt to rapid change in American health care, they will need not only education about the science of medicine as it is now but also education that prepares them to incorporate new information, new knowledge, and new capabilities into their practices. The educational reengineering necessary to realize this agenda will require aggressive and creative efforts by medical educators, who must be provided with the resources they will need to carry out this charge.

In this context, the Pew Health Professions Commission recently set an ambitious agenda to train the next century's health care professionals.[2] Two promising developments can move us toward the new practice world envisioned in the Pew Commission's *Third Report*: an increasingly refined understanding of methods for changing physician practice behavior and the advent of new

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technologies for information and communications. We must proceed carefully, mindful of the words of T.S. Eliot: "Where is the wisdom we have lost in knowledge? Where is the knowledge we have lost in information?"[3]

Technological change has been part and parcel of medical practice in this century. The technologies generated by biomedical research for medical diagnosis and treatment have been continuously integrated into practice since the 1960s. Medicine, however, has not yet sufficiently embraced the new technologies of information processing and communications. The resistance to change is surprising given the degree to which the practice of medicine is centered around the processing, evaluation, synthesis, and transmission of information. In a typical day, a staggering amount of information flows between health care professionals and their patients, colleagues, ancillary service vendors (such as laboratories and home health agencies), knowledge resources, and purchasers.

The need to enable and sustain this information flow is heightened by unexplained variations in medical practice; organizational change driven by the marketplace; the social and financial accountability newly imposed by purchasers, employers, and patients; and the difficulty physicians have in changing their own practices. At least two related developments will profoundly alter the training and continuing medical education of physicians: computerized physician workstations and communications technology. This revolution is forecast by the number of studies of changing the behavior of physicians that in some way incorporate computers as a tool; it is also clear when noting the ubiquity of computers in other industries. One can imagine that all medical practitioners, through detailed and real-time communication, will be able to align their own practices with state-of-the-art collective knowledge about the approaches to diagnosis and treatment—approaches that offer the greatest potential for benefit and the least potential for harm within the constraint of available resources.

This paper will address three questions. First, what do we know about how to change physicians' behavior, especially regarding the psychology and sociology of behavior change? Second, what new and evolving information technologies are likely to have an impact on the future practice of medicine, and how can physicians take advantage of health information technologies in order to practice the most effective style of medicine? Third, what strategic educational interventions will best enable physicians to manifest the competencies described in the Pew Commission's *Third Report* and adapt to evolving technologies so that they can practice cost-effective medicine? In other words, how might we best prepare a physician who is knowledgeable about current medical practice to embrace a lifetime of evolving science, organization, and financing?

Changing the Behavior and Practices of Physicians

Physicians may sometimes appear quite malleable in adopting new technologies and other times unresponsive to deliberately planned change.[4] There are six categories of methods for achieving change in physicians' practices: education, feedback, physician participation in the change, enforcement of administrative rules, financial incentives, and financial penalties.[5] A complex, interacting set of factors appears to drive physician decision making, with no one factor consistently dominating. It is thus difficult in most cases to affect all or even most of the important factors, and simple interventions have generally produced little if any sustained change. Greater success rates have come with multimodal approaches that combine several methods of improving medical practice.

Education

Continuing medical education (CME) strategies have been found to produce small or moderate alterations in physicians' practices and, in rare cases, small changes in patient outcomes. It is important to note, however, that CME—broadly defined as "imparting clinical information to physicians in order to persuade them to alter clinical practice"—is a collection of diverse approaches to conveying information.[6] It can involve the following approaches: educational materials, including computer-based interactive formats; formal conferences or seminars, including teleconferences; outreach visits by pharmaceutical, academic, or health plan educators; local opinion leader influence; patient-mediated education methods (such as patient reminders); and physician reminders. According to a recent review of the literature, the most effective of these approaches seem to be direct reminders, patient-mediated interventions, outreach interventions, opinion leaders, and multimodal combinations of the interventions. The combination of outreach and a trusted opinion leader appears particularly potent.[7] For example, targeted one-on-one intervention (known as academic detailing) has decreased the excessive prescribing of new and expensive medications,[8] improved blood transfusion practice,[9] and increased the use of antimicrobial prophylaxis in cesarean section surgery.[10] More traditional methods of imparting information (such as lectures and conventional written materials offered in print or electronically) seem less successful.

Practice guidelines are formalized protocols summarizing the best available evidence for treatment decisions about common conditions. They have been developed and implemented widely, but they have also shown varying effectiveness in changing practice.[11] Physician awareness of guidelines remains surprisingly limited outside of evaluation trials, calling into question their effectiveness in the absence of an aggressive dissemination strategy.[12] Guidelines may be effective, however, when given in specific ways. For example, computerized or paper-based reminders derived from guidelines and delivered to clinicians on a "just-in-time" basis appear to have a significant positive influence on physician practice change, at least in the context of a rigorous evaluation. Managed-care organizations have begun to

modify guidelines for use within their physician panels, but the structure and effects of these strategies have not yet been reported in an unbiased, evaluative manner.[13]

Feedback

Feedback to physicians regarding their practice patterns has become a common feature of managed-care practice. Physicians often receive multiple reports from separate insurers about selected groups of patients under their care. Most of the time, however, this information amounts to a summary of resource utilization. Less often, physicians' outcomes or other indirect measures of quality are reported back to them.

The effect of widespread use of a paper-based, performance-report feedback approach has not been well studied. Based on evidence provided by a limited number of rigorous evaluations,[5] it appears that physicians cannot respond well to feedback unless they believe that the process on which they are receiving feedback needs change or they can act directly to change the process about which they are receiving feedback. The majority of current feedback efforts do not have these characteristics, however, so they are likely to be of modest or no effectiveness.

Physician Participation

Continuous quality improvement interventions occur frequently in hospitals and health plans across the country, but careful evaluations are rarely conducted to assess the impact of these programs.[14,15] Gains in patient outcomes have been reported in nonexperimental settings, but the enthusiasm and advocacy of the proponents of these programs can hardly be separated from the effect of the programs themselves.[16] A randomized trial of continuous quality improvement methods to increase the use of preventive services is under way, and it will provide an opportunity for a more impartial evaluation.[17] Physician participation in quality improvement efforts is an intuitively desirable goal and a necessary precondition to successful practice change. It is important to note that physician participation by itself does not always lead to physician behavior changes or to improved patient outcomes.

Administrative Rules

Administrative rules restructure the physician work environment to achieve selected goals. They are not designed strictly to change physician behavior, but rather to restrict the options available to physicians either by direct intervention in decision making or by indirect restructuring of the practice process. Examples of indirect restructuring include altering pharmacy formularies to restrict the use of certain medications and altering test ordering forms to decrease the use of certain types of tests.

Direct intervention most commonly takes the form of utilization management, often described as "utilization review." The utilization management approach dates back to World War II and has been modified many times since then.[18] All utilization management programs have in common the insertion of a third-party reviewer who judges whether a treatment or procedure should be approved; he or she usually does so according to a set of explicit rules that have been established (for length of stay, for example). Utilization management programs differ from one another based on the timing of the management (prospective, concurrent, or retrospective), the training of the reviewer (physician, surgeon, nurse, or administrator), and the criteria for review (implicit or explicit). These programs often use administrative rules to determine appropriateness and feedback to give clinicians results.

Studied in many settings and formats, it appears that in virtually all cases the effectiveness of utilization management is limited, even for its stated goal of reducing utilization. In most instances, utilization rates may initially decrease slightly but then return to baseline—even while the intervention stays in place. In other instances, a one-time decrease in utilization occurs, after which the rate of increase is similar to the preintervention rate. As a behavior change method, some have speculated that utilization management creates a "sentinel effect," which is difficult to demonstrate and, if it exists, suggests that physicians may change practice principally for those elements of care directly subjected to review. An additional problem of utilization management is that it may not adequately specify which care is inappropriate or unnecessary. Therefore, utilization management, like other administrative-rule approaches, could decrease the rate of inappropriate *and* appropriate care. These concerns imply that administrative-rule methods such as utilization management, when designed to create barriers to using tests or treatments, are relatively inefficient and usually ineffective ways of achieving sustained behavior change.[19] Furthermore, these approaches do not expand the appropriate use of medications or tests for patients with pertinent need, nor do they control the inappropriate use of medications or tests for which barriers are not in place. They are usually perceived by physicians as meddling in the physician-patient relationship and in clinical judgment, and they are an important element of the "hassle factor" in medical practice.

Financial Incentives and Financial Penalties

The growth of managed care has brought more physicians into at-risk payment schemes than ever before. For instance, some part of a physician's salary may be subject to withholding or bonus payments depending on an assessment of his or her performance—usually limited to measures of resource utilization. This method is distinct from capitation payment, in which the physician accepts a fixed payment per patient for some period of time (a year, for example). There are many variations of at-risk payment schemes that can be characterized according to the intensity of incentives or disincentives, the areas of measured performance, and the size of the risk pool. In general, the more severe the risk, the more effective the scheme is in reducing utilization. Whether appropriate utilization is reduced is unclear and most likely depends

TABLE 1.—*Future Medical Provider Needs*

- Access to continuously updated and practical knowledge on an as-needed basis
- Access to consultants and teachers for both effective patient care and learning
- Rapid, efficient, and detailed communications links to ancillary service providers (laboratory, pharmacy, hospital, home health agency)
- Clinical data management tools for:
  - —rapid recording and retrieval of patient information
  - —integration of clinical data from outside sources
  - —population health management/preventive care
  - —self-assessment of clinical practice patterns
  - —tracking of financial consequences of clinical decisions

on many factors. Of note, at-risk payment schemes tend to eliminate the distinction between financial penalties and financial incentives by making them implicit and thus defined only by the physician's perception of what is a reasonable target income at any given time.

The effect of monetary arrangements in changing practice appears to depend largely on the financial arrangement already in place. Like administrative-rule approaches, financial mechanisms alone do not appear to change behavior in fundamental ways. In addition, physicians can obtain stop-loss insurance to mitigate the risk. In theory, this will blunt the power of the intervention. The research on the impact of financial incentives and penalties is scant, however, and it may be that these financial incentives and penalties were ineffective because they were simply too small.

The Impact of Information Technology on Changing Physician Behavior

Technological change poses both a challenge and an opportunity. The challenge is to educate physicians in the use of current information technologies and to adapt the practice of medicine to new devices. The opportunity lies in using the potential of information technologies to transform medical practice itself and craft interventions that will lead to more effective practice. In this way, technological change transforms medical practice, which then facilitates further technological change and application. This cyclical process is already taking place in some medical practices in response to the aforementioned market and professional changes. How might computerization and communication links play an important role in furthering these transitions?

Table 1 lists the operational needs that practicing physicians will have in the future. They will need access to information and to those who can help them use the information. They will need links to other health care professionals and tools to help them manage information.

Table 2 summarizes the current information and communications technologies that apply to medicine. It is unlikely that these lists will remain the same for five, let alone ten, years. The past ten years have shown how frequently yesterday's gadget is entirely replaced by today's invention. A recent article describing Internet applications has become almost obsolete because of the quick diffusion of the World Wide Web and its graphical browsers.[20] The information technologies in Table 2 are likely to evolve but remain, even as the devices change. For example, the personal computer may be a desktop model, a notebook model, or even a hand-held device. Data transmission may encompass signals passing over wires, through optical cable, via satellite, or by infrared beam.

We will address the four forms of information technology that will play the most important roles in supporting medical practice: computer-based decision support, computerized patient records, telecommunications technology, and computer-based simulators. An additional development is the growing use of the Internet as a health information resource by patients. The examination of this development is beyond the scope of this paper, but it is a movement that promises to transform the physician-patient relationship through electronic communication.

Computer-Based Decision Support

The term "decision support" encompasses all of the tools by which physicians can improve their decision making. These tools can be divided into two categories: passive and active. Passive tools are computerized knowledge resources that can be efficiently searched and used by the physician. Examples include textbooks, guidelines, journals, and prediction rules, which are formulas to estimate the likelihood of a disease or outcome based on patient factors. Computerizing these sources allows efficient updates, and they can be searched from a workstation without leaving the office. A future challenge is to identify for physicians products and resources that are the most current, accurate, searchable, and accessible.

Active tools are those that continuously survey computer-physician interactions and are programmed to intervene under a defined set of conditions. For example,

TABLE 2.—*Information Technologies*

- Knowledge Resources/Decision Support
  - —Passive support tools (Bibliographic reference, guidelines, journals, simulators)
  - —Active support tools (Notification systems, diagnostic tools, prediction rules)
- Communications Software
  - —Telemedicine
  - —Internet
- Computerized Patient Record (Data Management)
  - —Standardized, structured (relational), capable of integrating data from many sources
  - —Data analytic software tools
- Computer-Based Simulators

a system may provide prospective feedback to physicians at the time a test is ordered. This feedback might include advice as simple as the cost of a test or as complex as the likelihood that the test will be positive based on the known characteristics of the patient and presentation, or even a recommended algorithm for further work-up of the suspected diagnosis. Another active application is already frequently used with electrocardiograms: a machine-generated interpretation that the physician can use as a basis for his or her own interpretation. Active and automated health information system surveillance mechanisms have been shown to improve the quality of medical care.[21–24] In prototype settings, where order-entry is computerized, order templates decrease the variability of test and pharmacy use, and logical engines can screen for adverse drug events much more effectively than traditional methods for capturing them.[25] Prototypes of some diagnostic decision-support systems have been tested and found to have shortcomings, but refinement of their design and use are likely to follow.[26–28] In the foreseeable future, the artificial intelligence engines that process clinical data will be unable to reliably emulate complex expert thinking, but they will play an important supporting role by alerting the clinician to situations that require human intervention.

Computerized Patient Records

The computerized patient record has been a clearly articulated concept since the 1970s. Several workable models have been developed successfully, but implementation and dissemination have been difficult.[29] Despite much evidence of benefit in efficiency and quality of medical practice when computer-based records are partially implemented,[30,31] there are several problems that have worked against widespread adoption: the lack of standards for electronically storing and transmitting medical data, the awkwardness of data entry interfaces, the high cost of hardware and software acquisition and maintenance, worries about confidentiality and security, and limited exposure of health care professionals to computers.[32]

The Netherlands has already widely computerized its physician workforce.[33] What steps must be taken to make this possible in the US? The development of standards (through groups such as Health Level Seven and the American National Standards Institute) is moving forward aggressively. The National Committee for Vital and Health Statistics has been charged through recent legislation to accelerate the adoption of electronic data exchange standards including standardized medical vocabularies, unique patient and physician identifiers, and security and confidentiality standards.[34] Interfaces are improving greatly through the use of graphical display and the development of portable hand-held tools. The multimedia capacity of most personal computers can already support the storage and retrieval of sounds, images, and video recorded during physical examinations. Hardware and software are much less expensive today than in the past. Cultural barriers may be falling as physicians, especially those who have used computers throughout college and during medical training, learn of time-saving advantages for tasks such as retrieving laboratory results, entering orders, and prescribing medications—tasks that are poorly supported by conventional paper medical records.[35–37]

Legitimate concerns have been raised about the security and confidentiality of medical records stored in this new medium.[38,39] Finding the solutions to these problems is not trivial, and ensuring that they are solved will greatly enhance the adoption of computerized patient records.[40,41]

Analytic capacities that follow naturally from the adoption of computerized patient records will include the computer automatically notifying the physician and patient when preventive services, follow-up tests, or prescription refills are due. In some settings, computerized patient records are already useful to physicians who want to profile their past practice, benchmark their practice against other groups of physicians' practices, assess outcomes of treatment for patients with a defined condition or finding, and closely track resource expenditures day by day. The power of these capabilities to influence practice is not yet known, but it is likely to be substantial.

Telecommunications Technology

Two forms of communication technology have developed separately, but are likely to merge over time: telemedicine and the Internet. Telemedicine is the linking of geographically separated health care professionals using electronic means (not limited to the Internet).[42] Telemedicine technology creates new capacities for the delivery of expertise to distant or logistically problematic places (such as prisons). The most advanced thinking in this area has occurred in military medicine, in which the problem of bringing surgical expertise to the extreme forward end of the battlefield has fostered the testing of systems that allow a medic armed with interactive technology on the scene to transmit images and data to a trauma surgeon off the battlefield. In the most advanced application, a mobile surgical robot can be positioned with the victim and directed by the distant base surgeon using a specialized workstation with built-in virtual reality technology.[43] Specialized microsurgery is another extension of this concept.[44]

In more routine civilian clinical application, the isolation of physicians and expertise in dispersed practice sites can be overcome through telemedicine technologies. Such a capability can enhance communication between specialist and generalist providers; its implementation has occurred in many rural settings.[45] It can include sound and video capability sufficient for physicians to perform almost any part of the physical examination—auscultating heart sounds or inspecting skin lesions, for instance. Many educational programs are beginning to take advantage of telemedicine as a teaching tool. The need to deliver centralized didactic and interactive teaching to medical students and residents who are scattered in ambulatory sites could be met

through multiple interactive audiovisual downlinks if providers had such technology in their offices.

The most notable breakthrough of Internet technology is in the ability to link independent computers without having to share all of their software.[46] The capacity of the Internet for linking physicians to patients, to passive knowledge bases, to active decision-support tools, to other physicians, and to ancillary services such as laboratories or pharmacies far exceeds its current use. The decentralized architecture of the Internet is well suited to the organizational changes that require linking small geographically dispersed practice groups into larger information-rich structures.

The Internet offers specialized capacities such as e-mail, topical discussion groups, and ease of access to both passive and active decision support tools. Many government agencies, specialty societies, medical journals, commercial health ventures, and patient advocacy groups maintain web pages. A properly trained person can access and download guidelines, alerts, medical literature, and statistics rapidly through a personal computer no bigger than a notebook.[47,48] Training in the effective use of World Wide Web–based knowledge resources will be an important asset to future physicians.[49]

Computer-Based Simulators

For more than three decades, Air Force pilots have used simulators to prepare for combat. In medicine, simulation applications range from simple to complex. At the simple end of the spectrum, a large number of software programs, many in the public domain, can guide physicians through advanced cardiac life support (ACLS) protocols or diagnostic dilemmas by presenting text scenarios with multiple choice response opportunities. With newer, more powerful computers now available, these programs can be enhanced with graphic images such as physical finding photographs, electrocardiographic tracings, diagnostic imaging results, histopathologic findings, and even video clips. The branching logic of the clinical scenarios can mimic the diversity of real clinical cases. At the complex end, simulators strain the current available hardware capacity to create the visual, auditory, and sensory experience of a procedure such as endoscopy, arthroscopy, or surgery.[50–52] However, the rapid advances in hardware power will soon support widely available virtual reality simulations.

For those in medical training, simulation offers the opportunity to confront clinically realistic decisions without putting actual patients at risk. The generalist can evaluate and manage rare cases that would otherwise be unlikely to present during a training period. The tertiary care–based specialist can evaluate and manage common conditions that may rarely be seen in the hospital. These educational tools can provide feedback to the trainee about his or her decision-making as well as the evidence and logic for preferred approaches to clinical management. Although the power of simulated decision making and education appears able to influence patients dramatically[53] and preliminary studies of the effectiveness of simulation-based feedback and education are promising, more studies are needed.[54–57]

Recommendations for Future Training

The case has been made for incorporating information technologies into medical education and training.[58,59] The potential of information management tools to change behavior and thereby shape medical practice is outlined above. A recent, brief essay by Bates and Komaroff articulated a type of future virtual group practice.[60] Knowing what we know about changing physicians' behavior, what are realistic steps in curriculum development and incorporating information systems tools into both medical education and practice? We suggest that four principles guide this effort:

1. Physician participation in the development of the information system infrastructure must be a high priority. Those who have successfully adopted computer-based medical record systems engaged physician leaders in the development process.
2. Education about information technologies must be interactive and sustained, and it must involve teachers who use information and communications tools themselves.
3. Performance measurement and monitoring, although important in assessing minimal standards of competence, should not be the sole or primary objective of creating information systems. Compelling literature suggest that judgment-based systems tend to precipitate resistance or at best indifference.[61,62] Using these tools primarily for utilization review is likely to make their implementation more difficult and may sacrifice other potential benefits.
4. Physicians and educators should ensure that health information practice tools are nonproprietary or at least can be independently and publicly evaluated. Decision support tools must be open to scrutiny, especially if they will be used to evaluate the balance between costs and benefits of alternative diagnostic or therapeutic strategies for individual patients.

We recommend the following to develop an appropriate curriculum for medical education that responds to these challenges.

1. A foundation in basic computer literacy should be a requirement of entering medical students.[63]
2. Applied medical informatics should be introduced early in the curriculum to increase future physicians' familiarity with the basic information tools of practice (including using computerized medical records, retrieving computer-based knowledge resources, and understanding the basics of the Internet).

3. An evidence-based curriculum should include training in health evaluation sciences (such as cost-effectiveness analysis, decision analysis, health services research, and basic statistics knowledge) with an emphasis on practical approaches to drawing inferences from databases and using data to understand the health of populations.
4. The curriculum should introduce a quality improvement paradigm that includes system analytic, process, and outcomes-assessment modules and introduces methods for critical self-assessment and behavior modification.
5. Interdisciplinary team approaches to learning and studying should be incorporated into the early years of medical school to facilitate broader system-based thinking, conflict resolution, and management skills.
6. The training of medical informaticians should be a priority for medical educators—there will be a sizable need for trained personnel to create, maintain, and constantly upgrade the knowledge infrastructure that will support clinical decision makers in the future.
7. Academic medical centers should take on the important role of evaluating the software that is applying the medical knowledge base to practice and ensuring that it is sound (for instance, that it transmits correct knowledge and does not implicitly discriminate against certain classes of patients).
8. Research and teaching about methods for ensuring confidentiality and security of electronic records and communication should be incorporated into medical education.

Conclusion

There are multiple technological changes in motion that challenge us to think creatively about preparing future medical practitioners. In the context of the social and economic turmoil that will continue to confront the present day health care professional, the full effects or uses of technology cannot be predicted easily. In this new era of medical care, health care professionals will have to be accountable for clinical decisions as never before. The importance of systematically measuring appropriateness of the process of medical care and its effectiveness in patient terms is paramount; physicians will be expected to change their practices according to the findings of such measurements.

The speed of change in the knowledge base of medical science has long been considered a threat to traditional medical education. Today, existing knowledge is revised so often that clinical algorithms acquired to care for patients with a disease such as HIV infection become obsolete within a few years if not months. New areas of knowledge and evidence relevant to clinical practice but not traditionally part of the curriculum of medical training have come of age as useful tools to guide practice. The application of quantitative decision models to what have traditionally been intuitive clinical decisions (or heuristics) promises to reduce some of the variability of clinical decision making. Cost-benefit analysis, clinical effectiveness, health status, and functional assessments, as well as guidelines and prediction rules now need to be incorporated into the practitioner's lexicon.

Many educational changes will be necessary; information and communications technology can make it possible for health care professionals to function effectively and rapidly adapt new practices in this new world. If the experience of other service industries (such as banking or airlines) can be viewed as a guide, the resources devoted to health care information management (currently estimated at less than 3% of revenue) will grow dramatically over the next ten years, simply to match what is invested in other information-rich industries (close to 8%). The integration of information technologies into health care has been predicted for many years, but it has never quite passed the formidable hurdle of practitioner acceptance and adoption. Soon, practitioners will have neither the option nor the desire to resist if they intend to practice the most effective style of medicine.

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