Health Information Technology Will Shift the Medical Care Paradigm

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The current paradigm of medical care depends heavily on the autonomous and highly trained doctor to collect and process information necessary to care for each patient. This paradigm is challenged by the increasing requirements for knowledge by both patients and doctors; by the need to evaluate populations of patients inside and outside one's practice; by consistently unmet quality of care expectations; by the costliness of redundant, fragmented, and suboptimal care; and by a seemingly insurmountable demand for chronic disease care. Medical care refinements within the old paradigm may not solve these challenges, suggesting a shift to a new paradigm is needed. A new paradigm could be considerably more reliant on health information technology because that offers the best option for addressing our challenges and creating a foundation for future medical progress, although this process will be disruptive.

KEY WORDS: health information technology; medical care; paradigm shift.

J Gen Intern Med 23(4):495-9

DOI: 10.1007/s11606-007-0394-y

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A scientific paradigm shift occurs when an old model of knowledge and practice cannot accommodate inconsistencies or challenges arising from new experience, and when a replacement paradigm offers a better foundation for progress.¹ Although paradigm shifts generate new solutions, they also disrupt previously secure and successful theories, practices, and social arrangements. Nearly a century ago, Abraham Flexner recognized American medicine's prevailing challenges. His 1910 report on American medical education was instrumental in the shift to the paradigm emphasizing scientific, academic preparation of physicians who then become the credentialed, medical service decision makers. As our dependency on highly trained, individual physicians who apply their knowledge through distinct patient care encounters has worked well, is it really possible that today's challenges require something as disruptive as a paradigm shift? Our current paradigm is challenged in the areas of knowledge, prevention, quality, costs, and manpower. A new paradigm for addressing these challenges could depend more on information technology.

CHALLENGES

Medical Knowledge. To accommodate knowledge proliferation with the current paradigm clinicians must learn how to manage current literature better^{2,3} or specialize. The latter works poorly when many of the common knowledge challenges we face today relate more to quantity than complexity. For example, preventive health practices rated as A or B recommendations by the US Preventive Services Task Force are well summarized and accessible, but Yarnall et al.⁴ estimated that counseling patients about them would require 25% of a typical generalist's workweek, and to conduct other recommended screening tests and actions would occupy another 25%. Our patients also face daunting knowledge challenges. For instance, helping diabetic patients acquire self-management skills requires substantial organizational resources and commitment.⁵ As the current paradigm assumes clinicians will accomplish these responsibilities during face-to-face encounters, it is not surprising that progress has been slow and uneven.^{6,7}

Prevention. As with the knowledge challenge, a physician and visit centric paradigm is a tiny window through which to achieve or track optimal preventive care for individual patients, but especially for populations. Populations of concern vary from all school age children needing complete immunization care to populations with specific risks (adenomatous polyps) or with specific exposures (medications). For example, vaccinating the population of adults over 64 years old for pneumococcal disease has been a goal for nearly 30 years.⁸ Although gradually improving over time, the national mean of 64% in 2004⁹ is far from the *Health People 2010* goal of 90%.¹⁰ Another current paradigm challenge is identifying new disease trends, because we must rely on attentive clinicians who experience unusual patient care events, recognize them as aberrant, and report them, or we must establish specialized sentinel reporting systems.

Quality. As so much medical care involves acquiring, sorting, categorizing, exchanging, imparting, and using information for treatment decisions and actions, it is not surprising that quality suffers when information handling relies so heavily on individual health professional worker accountability and training.¹¹⁻¹³

Our medical errors are built on a foundation of missing information. For 14% of primary care visits, historical, examination, test, medication, or report information is missing, and about half of those instances delayed or impaired care.¹⁴ The

typical patient and doctor do not need a study to verify this, as they are common events in American medicine today, and the reason my mother, like other seniors, carries her medication list in her wallet.

As quality currently depends so much on autonomous clinician actions, variable and tardy guideline adoptions have become enormous problems. This has prompted analysis into practice systems and characteristics underling quality success or deficiency,^{15,16} especially for chronic care.¹⁷

Cost. Attempts to control medical care costs with the existing paradigm have not succeeded. In fact, the highly trained, autonomous clinician desires to independently verify and acquire patient information, which contributes to redundant information gathering, especially when patient records are scattered across the community and when payment for repeat services is available. Redundant test ordering costs an estimated 9–20%,^{18,19} and the current paradigm contributes to an environment where preventable, inpatient adverse drug events are estimated to cost several thousand dollars for each patient.^{20,21} One in 7 hospital admissions is related to not having all prior patient information available.²²

Autonomous, specialized clinicians and visit-based patterns may be efficient for acute problems and discrete episodes, but they contribute to fragmentation and higher costs for chronic care. Spending for patients with multiple chronic illnesses contributes far more than acute problems to increasing expenditures²³ and the typical Medicare patient sees 2 primary care and 5 specialty practitioners each year.²⁴

Manpower. A recently recognized challenge is declining primary care capacity,²⁵ which may powerfully impact future, chronic care. A colleague has termed the combination of shrinking primary manpower, rising diabetes prevalence, population aging, unsustainable costs, expanding beneficial treatment guidelines, and poor adoption of those treatments as the diabetes “perfect storm” (Murata GH, personal communication). Our dependence on a shrinking health professional pool begs for a new model of care.

NEW HIT PARADIGM SOLUTION

Placing computerized information systems at the core of health care might better address our challenges. Computerized and internet-based information already make current knowledge accessible to practitioners and patients, so improving these channels and linking information sources to practitioners and patients through electronic medical records (EMR) can diminish knowledge challenges. Evidence of the first step is already present by requiring EMRs to provide access to guidelines.²⁶ When more data about patient care becomes digital, retrievable and analyzable across millions of lives and care episodes, the potential for rapidly learning and applying better health care decisions is enormous.²⁷

Using health information technology (HIT) to consistently deliver numerous, repetitive preventive care tasks is particularly appealing. Presumably, the computerized records and reminders employed by Veterans Affairs health care systems were partly responsible for significantly better pneumococcal vaccination among veterans receiving VA care in 2003,

although the success rate was still only 68%.²⁸ Advancing this HIT paradigm, we used the VA computerized system to identify the entire population needing immunization, and achieved 90% success with letter or phone vaccination campaigns separated from usual practitioner actions and clinic visits.²⁹ The growth of childhood immunization registries across the country³⁰ also demonstrates the appeal of HIT solutions, as does the prospect of electronically sifting through large volumes of routine care events (claims, diagnoses, laboratory events, etc.) to detect rare events (biosurveillance).³¹ Dependency on HIT instead of practitioners is inherent in this evolution.

The overlap between the prevention and quality challenges needs HIT solutions, such as identifying all patients prescribed rofecoxib and mailing them alerts within days.³² Next steps are building community-wide disease registries for tracking needed care while accommodating variable care intervals, and maintaining correct addresses, practitioners, or health care funding arrangements. Such a HIT system would be valuable for patients needing regular surveillance colonoscopy for adenomatous colonic polyps, thus minimizing either too frequent or missed surveillance.

For quality improvement, Berwick suggests linking information to decisions instead of practitioners and visits,¹⁵ and a key to this solution is the electronic medical record (EMR). A secondary solution is electronically conveying patient information between care sites in a standardized, secure, and private manner, much in the same way we have become accustomed to managing financial or travel information and decisions. Connecting every doctor and patient to scattered information through interoperable EMRs will prepare us for the real paradigm shift: employing EMR decision support technology to assist clinicians and patients with thousands of decisions. HIT will then become a crucial and accountable component of the clinical paradigm. That change can be seen now in its earliest stages because clinician alerts about allergic or drug–drug adverse drug interactions must arise during electronic prescription entry with any nationally certified EMR.³³ The volume of adverse drug reactions, estimated to occur during 6–10% of hospitalized patients and to cause 9 million additional outpatient visits each year,^{34,35} compels a shift in accountability from individuals to HIT systems.

Berwick explains that the current paradigm of physician autonomy leads to compromising variation.¹⁵ With a new paradigm, best practice guidelines can be imbedded in EMR decision support so that normal clinical workflow can reduce variation. When best practices are unknown, HIT can assist organizations in collecting much more information about patient characteristics, outcomes, and physician decisions to better and more quickly inform future decision makers.²⁷

Fully deployed EMRs can reduce costs by reducing the number of visits needed to provide care,³⁶ so perhaps the greatest HIT cost savings potential is the same as in other US industries: worker productivity. U.S. health care productivity has actually had a negative impact on overall U.S. worker productivity.³⁷ A significant portion of that lost productivity can be attributed to retrieving information about each patient when it is scattered around the typical medical community. Walker et al.³⁸ estimate that an electronic exchange to collect that information would save \$78 billion by itself. If pay for performance becomes part of our medical accounting fabric, it is hard to conceive of an accurate and functional pay for

performance system without substantially better HIT systems to quickly collect and organize care information for prompt clinician feedback.

For me, the most persuasive argument for a paradigm shift is declining primary care manpower and rising chronic care needs. Advancing HIT solutions may be key to reducing bottlenecks related to declining clinician numbers. Evidence already supports redesigning clinic teams with excellent HIT to improve chronic disease care³⁹. The right incentives could unleash new ways for patients to use computer-based, training, questioning, and advising, that results in shared decision making without formal clinical encounters. The process could utilize devices ranging from examination room computers to cell phones. Sessions could document care details and progress for the patient's personal health record and for the institutional EMRs. These HIT resources would be accessible around the clock to engage patients at their convenience. Also, by wisely integrating HIT into clinical workflow, clinician time could be used more efficiently and allow them to devote their efforts to more complex needs and patient interactions.

Imagine having assistance outside busy office visits to remind diabetic patients to obtain hemoglobin A1c tests or eye examinations, to accumulate and assess the blood pressure measures taken by your hypertensive patients for goal achievement you have established, or to query patients about medication effects and side effects. Consider your typical 52-year-old patient completing his prostate counseling session, documenting his decision, and obtaining his PSA test, before his office visit for a digital rectal exam. Patients can already calculate their own cardiovascular risk assessment.⁴⁰ A further HIT paradigm step would involve linking the patient's risk assessment and latest lab results with his electronic record. Then, the patient could review authoritative and current recommendations, enter information about preferences, and receive personally tailored treatment advice based on his preferences and health characteristics noted in his interoperable EMR, before physician contact. HIT solutions can incorporate the latest education and recommendations for patients and physicians alike, thereby reducing knowledge and quality gaps.

As the number of evidence-based decisions and guidelines increase, it is easy to imagine becoming more dependent on computerized information systems. The same information systems could engage patients in ways that are needed for habit change, but which are hard to achieve in brief clinic visits. New information systems can arise from de-identified data care repositories derived from multiple EMRs or claims files, and these offer the potential to use the outcomes of thousands of patient treatments and actions for considerably more informed recommendations.⁴¹ Finally, genetic testing information will add another layer of influence for decision making, placing even greater strains of existing physician cognition and visit-based interactions. Given our current challenges in accessing, compiling, and considering information for specific treatment decisions, adding a genetic information facet urges us to adopt new information handling approaches.

BARRIERS

We face substantial barriers to adopting HIT solutions. First, the diffusion of any change across a community of humans is slow, requiring substantial social interactions, changes in

perceptions, trials, and repeated communication.⁴² Thus, decades may transpire before change is complete, whether that be from cottage work to modern industrialization or from fixed line phones to cell phones.

The cost of HIT adoption is considerable, estimated to be \$500 billion over 5 years.⁴³ Furthermore, potential savings from HIT are more likely to be realized in future years, so that investment must compete with current service demands. Although worker productivity can improve with HIT, the financial burdens (EMR cost and entry time) fall on front line practitioners, who experience temporarily reduced productivity and disruption,⁴⁴ whereas the efficiency benefits of their efforts accrue more quickly to others.⁴⁵

This article was not intended to review all possible HIT solutions. Admittedly, they are incredibly diverse, often difficult to use or integrate into workflow, and even flawed, as demonstrated by errors introduced by an implementation of computerized physician order entry⁴⁶ and by the incomplete realization of advantages promised by decision support technology.⁴⁷ It is easy to conclude they are immature when a large number of developed EMR products have not achieved national certification. Health care IT solutions have not arrived as quickly as promised during the last 30 years,⁴⁸ and current promises may be more hyperbole than real benefit.⁴⁹

The lack of information and communication standards across products challenges the new paradigm because the new paradigm depends on seamless interoperability between different HIT applications, so that patient information can flow between different systems without requiring complex translational interfaces or suffering information corruption. This standardization process has received a major push recently,⁵⁰ but still has a long way to go.⁵¹ Protection of intellectual investments in HIT systems challenges interoperability and innovation, especially when the marketplace for HIT must compete for patient care services.

Privacy concerns by patients and competing health care organizations and insurers inhibit new technology solutions. Not only do our patients need assurance of their privacy, but also they must be willing to use the technology. As cultural, educational, and financial barriers already disadvantage some patients, greater reliance on HIT might exacerbate disparities.

COULD HIT CONSTITUTE A PARADIGM SHIFT?

The challenges faced by American health care organizations, practitioners, and patients are complex and will need complex solutions, such as ones advanced by the SGIM Blue Ribbon Panel in March 2007,⁵² which include adopting HIT. Diffusion of HIT into our future work environment is certain, but that does not necessarily constitute a paradigm shift. Even if the barriers mentioned above are overcome with widespread and creative HIT solutions, some will consider that a modification of the existing paradigm rather than a paradigm shift. The current paradigm also provides a solid foundation for medical procedures, which must be performed by credentialed, accountable, specialized individuals. Although HIT may impact judgments regarding those procedures, HIT replacement of specialized individuals is unlikely.

Despite these caveats, a paradigm shift occurs because the existing paradigm cannot solve the current challenges and because fundamental change must occur to progress. I believe

HIT solutions will eventually be more than adjustments to our current paradigm, as we shift our dependence from people and discrete clinical encounters to systems of care built around comprehensive, interoperable information systems, which can be used at dispersed locations and times, even if that takes several decades to transpire.

Perhaps the greatest risk of an HIT paradigm shift is dehumanizing care with more interactions between computers and patients or doctors, raising the science fiction specter of health care delivered by robots. Of course, my hope is the opposite. Greater reliance on HIT might allow clinicians to spend more interpersonal time with patients. I take heart in the fact that patients and physicians shared trusting and caring therapeutic alliances for many years before Abraham Flexner changed the medical care paradigm. In fact, that paradigm shift improved the therapeutic alliance because patients could then be more assured their care resulted from wise and effective decisions. A new, HIT-based paradigm might assure the same in the future.

Acknowledgments: *I wish to acknowledge perspicacious collaboration with Dan Gray, many formative conversations with colleague Glen Murata, and the thoughtful efforts of two reviewers.*

Conflict of Interest: *None disclosed.*

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