

# The role of AI in building a culture of partnership between patients and providers

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## Abstract

The medical community needs IT applications that support safe, effective, patient-centered, timely, efficient, and equitable healthcare. Improving communication between patients and providers is one area where IT can help. A new patient-centered care process environment should be built; in this data analysis environment patients can ask appropriate medical questions and obtain clear explanations. AI technology can help tailor the environment for a specific patient's needs.

## Introduction

Despite technological advances over the past thirty years, and significant investments made in information technology (IT) by the medical community, computer technology has still yet to produce the innovation needed to mature the organization and delivery of care. (Kaushal 2005, pg. 106) A complicated mix of political, economic, sociological, and technical reasons are largely responsible for the shortcomings of health care IT systems. Although an adequate discussion of these issues is far beyond the scope of this paper, one persistent reason for these failings is that IT investment has been focused on addressing the economically lucrative business side of health care delivery, instead of dealing with the significantly more complex orchestration of patient care. (Kaushal 2005)

In spite of the fact that the past performance of IT has been checkered, the medical community still looks toward advances in IT to help solve many health care problems. The Committee on the Quality of Health Care in America was formed by the Institute of Medicine in 1998 to develop a strategy to improve the quality of health care over a ten year period. Subsequently, the committee authored

Crossing the Quality Chasm which outlined key dimensions for health care in the 21<sup>st</sup> century: health care needs to be safe, effective, patient-centered, timely, efficient, and equitable. In the same report, they stated that, "The committee believes information technology must play a central role in the redesign of the health care system if substantial improvement in quality is to be achieved over the coming decade. Automation of clinical, financial, and administrative transactions is essential to improving quality, preventing errors, enhancing consumer confidence, and improving efficiency." (Committee on Quality of Health Care in America 2001, pg. 16)

Furthermore, in 2004 President George W. Bush signed an Executive Order "to provide leadership for the development and nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care". (Executive Order)

The order stated that this infrastructure "Ensures that appropriate information to guide medical decisions is available at the time and place of care ..." Nevertheless, the adoption rate of electronic health records and the ability for current generation applications to reduce medical errors have remained lower than many had hoped for. (Agency for Healthcare Research and Quality 2005)

This paper will focus on the role of AI in building a culture of partnership between patients and providers through software applications that better address health care delivery needs. Provider organizations, i.e., hospitals, manage frequently competing relationships between different types of stakeholders: patients, administrators, physicians, nurses, payers, etc. The authors posit that a readily understandable, longitudinally accurate, fact-based contextualized patient health representation, probabilistically

contrasted with a broader yet homogeneous patient population model, is the so called rosetta stone needed to support collaborative communication and safer engagement between stakeholders.

### **Problem Statement - Information Asymmetry and Communication Issues**

The cost and quality of health care delivery is significantly affected by the information disparity that exists between health care stakeholders. Developments in two areas of economics, the studies of asymmetric information and agency relationships, have previously been applied to aspects of these problems. Asymmetric information pertains to the condition where buyers, or in our case patients, and sellers, or in our case physicians, possess different levels of information. Agency relationships pertain to the condition where information deficient buyers or sellers rely on external parties to facilitate decision making.

Physicians, based on their extensive education, are formerly trained to be both aware of and understand treatment alternatives, and to make decisions with both asymmetric and imperfect information. Inversely, patients are often poorly informed, compared to physicians, about their condition, treatment options, expected outcomes, market average pricing, and physician experience. Based on this information disparity, physicians and other care delivery stakeholders need to be highly skilled at handling and communicating with patients and their families. Unfortunately, the often high number of engaged providers and the typically short amount of time allotted for communication, limits message effectiveness for all but the most skilled communicators.

For example, physicians need to be able to quickly and effectively explain complex medical and physiological phenomena, including disease symptoms, disease causes, surgical procedures, treatments, and test results. Since care delivery is a process, productive communication should in reality occur throughout the course of treatment in a continuous or event-based manner. The frequency of synchronous and asynchronous information exchange should be adjustable based on situational appropriateness and level of stakeholder understanding, e.g., a patient, or other family member, may wish to stay informed of, and monitor, potential drug side effects, or report changes in health

status, amount of anxiety being experienced, or new medical research that they or their family members may have discovered.

Patients typically understand, to a degree, their health status and the type, severity, and frequency of their related symptoms. Unfortunately, for their understanding to become actionable during the care delivery process, it must be effectively shared in a manner that can be comprehended by their providers. Some patients are able to communicate easily, while others can not for a variety of reasons. Some of the reasons for inadequate communication could be that the patient has poor verbal skills, is uncomfortable talking about his/her health, is intimidated by the care providers, system, or situation, or is confused by the level of information discussed or gathered by many different personnel.

### **Some examples of what is needed**

Information needs to be made both available and consumable for patients and providers so that they can be empowered to make informed decisions in partnership. Future software applications must therefore be built, and associated information must be designed with all stakeholders in mind. For example, if a patient is informed that they should undergo a hip replacement surgery, they should also be able to easily discover and understand both general educational information and specific performance information such as:

- How many and what type of complications have occurred for patients seeing a particular surgeon, all physicians at that hospital, all physicians at all hospitals in the state, and all physicians at all hospitals in the nation?,
- What is the prognosis for patients seeing a particular surgeon, all physicians at that hospital, all physicians at all hospitals in the state, and all physicians at all hospitals in the nation?, and
- What is the recommended recovery process that should be followed to maximize future range of motion? How often are repairs necessary? What medical research is being conducted in this area?

Hence, patient-centered care process applications should be designed to: (1) longitudinally represent patient history, (2) clearly present or explain current patient care, (3) monitor patient progress, and (4)

allow engaged stakeholders, e.g., patients, physicians, and nurses to communicate, manage care and work as collaborative, equal partners. While patient-centered applications should provide patients, their families and practitioners with all “relevant” information, the IT application should employ an information design<sup>1</sup> that does not overload the users or provide them with unwanted information:

- Too much information, e.g., a patient should not be provided regional outcomes of a procedure if they are not interested,
- Non-consumable information, e.g., information that may not be usable since it was not adjusted for severity of illness, and
- Technical information that is too difficult to understand, e.g., numeric results without explanation or comparison information from a specific test.

The goal of the care process application is to treat patients as intelligent health care consumers and to bring into balance their understanding of their own situational health and care. Patients have the right to see all of their health information and it should be represented and displayed so that it could be easily understood by them.

Physicians also need better information so that they can understand the best practices for treating specific illnesses. For example, they need applications to display and clearly explain information, such as:

- For a specific diagnosis related group (DRG), how many services, service types, and service days are typically utilized in the course of treatment by a physician and his/her peer group organizationally, regionally and nationally, and
- For a specific DRG, what outcomes are typically realized by a physician and his/her peer group organizationally, regionally and nationally.

From this health information, physicians will be better able to see whether significant variations in practice or outcomes exist. This information will

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<sup>1</sup> A systematic arrangement and use of communication carriers, channels, and tokens to increase the understanding of those participating in a specific conversation or discourse. (Jacobson 2000)

help physicians make evidence based decisions. They will be able to consistently provide better care, achieve better patient outcomes, and realize higher levels of safety, effectiveness, timeliness, efficiency, and equity. Additionally, patients and their families could provide a more informed level of second tier monitoring and management not previously available to providers.

Financial information and analyses can also be provided. Financial information by population, e.g., DRG, can be analyzed to allow administrators and physicians to work together on a common set of objectives. Physicians could better understand how their role in planning discharges, selecting drug protocols, and ordering routine tests affect the profit and loss of the institution. Their actions could reduce waste and the use of unnecessary resources. (Committee on Quality of Health Care in America 2001, pp. 188-189) Financial information can also be presented to patients so that they can understand clearly their charges and how much coverage should be provided by their insurers.

### **How artificial intelligence can help**

In the 1980's a number of AI systems were built to perform or support physician diagnostic functions, e.g., MYCIN, which performed rule-based infectious disease diagnosis and therapy, VM, which monitored patients receiving mechanical breathing assistance in the intensive care unit (ICU), INTERNIST, which performed computer-assisted diagnosis for general internal medicine, and others. (Buchanan and Shortliffe 1985) (Clancey and Shortliffe 1984) While these systems performed at an expert level, they did not replace the physician and patient relationship nor change medical practices.

Rather than just duplicate the diagnostic functions of a physician, AI technology could be used to improve patient-centered care process environments. These types of applications could be built out from a collection of conventional and advanced analytic tools. However, even if they were available, care delivery personnel would have difficulty knowing where to start, i.e., which tool to use in a given situation, and also in interpreting results. Users would need to be supported and AI techniques could provide assistance in many areas:

- The authors propose that an environment should have many functional capabilities.

There needs to be automated assistance to select, clean and retrieve appropriate patient population data and select appropriate learning, analysis, or reporting technique(s) to invoke depending upon the context of the specific medical/financial problem. This type of help could be based upon flexible case-based reasoning techniques. Another approach would be to design strategies to allow for techniques to be combined in appropriate and useful ways. That is, the output or results of one analysis would be used as input into another type of data analysis. This strategy was previously employed for an analysis of DRG and financial data. A set of templates for segmented analysis, like the analyses described in the previous section, could be predefined. (Silver, Sakata, Su, Herman, Dolins, and O'Shea 2001)

- For each analysis performed, there needs to be an explanation about why it was performed and if its results were significant. It will be possible that different analyses will yield newly discovered patterns from the sourced, cleansed and enhanced clinical and financial data. This area pushes the state-of-the-art in data mining; that is, how one would know whether results are obvious or meaningful. This also pushes the state-of-the-art in natural language generation, i.e., explanations would require a significant amount of medical domain specific knowledge and knowledge about the interpretation of analyses.
- Based upon prior analyses, users may want to edit data before performing supplementary analyses. That is, they may want to perform hypothesis proving what-if analysis. Before performing what-if analyses, they may want to easily delete outliers, change data values, merge data sources, etc. An intelligent data editor is required to abstract complexities away from users and to allow them to flexibly alter subsets of data for what-if analyses.
- New types of analyses and presentation techniques are required to support the analysis of care processes for

homogeneously segmented patient populations. A system like VAR-IMGR is an example of a new type of approach that has been applied to hospitalization encounters. This research effort provided a unique population definable representation of billable services incurred over time based upon different measures, such as frequency or cost. (Bito, Kero, Matsuo, Shintani, and Silver 2001)

Information sharing can greatly enhance the doctor-patient relationship and improve overall health education. The authors believe that the focused introduction of AI into the care process can provide the catalyst needed to help build a culture of partnership between patients and providers.

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