Future of Information Work Healthcare 2015

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Healthcare and Information Work: Overview

Improving Healthcare Productivity Is Critical

Spending on healthcare in the United States is projected to reach $1.9 trillion in 2005, and according to a report from Boston University, 50 percent of those dollars will be lost to waste, excessive pricing and fraud.[1] Improving the productivity and efficiency of healthcare is therefore a critical economic priority for patients, providers and payers. However, unlike many other industries, productivity in healthcare is not measured only in dollars, but also in human lives.

Improving efficiency in healthcare cannot be separated from the central goals of improving outcomes and extending access — objectives that often incur costs. And because healthcare depends disproportionately on the skills and knowledge of the practitioner, successful productivity solutions must conform to established practices rather than forcing changes on users.

Information Technology Is the Key

Information technology (IT) is seen as central to achieving these goals, both because of its success in driving similar efficiencies and productivity in other segments of the economy, and because healthcare as an industry is so information-intensive and highly collaborative. Although back-end systems and infrastructures will continue to provide the technological foundation for process improvement, most people in the system will experience IT innovations in healthcare at the point of contact: the end-user application environment or “information worker” (IW) platform.

The role of information work technology is especially critical because nearly every healthcare worker epitomizes the role of “information worker.” That is, everyone from providers to administrators to support staff depends on having access to the right information at the right time and in the optimal format to make the decisions critical for their jobs. Moreover, for practitioners, the amount of information being generated through research is increasing faster than can be absorbed by the individual. It is ironic, then, that the healthcare field in many developed countries has been among the slowest to adopt the kind of IT solutions that have driven efficiencies and productivity improvements in so many other aspects of the economy.

Adoption Has Been Slow, But Is Accelerating

There are many reasons that adoption in the medical field has been so slow: the cost and complexity of IT infrastructure, the limitations and difficulty of proprietary applications, the lack of standards,[2] and perhaps a general comfort with the traditional practices of paper records, handwritten notes, informal meetings, face-to-face conferences and consultations. Unfortunately, the persistence of these low-tech information management methods in the face of increasing systemic complexity has produced a situation of inexorably rising costs, narrowing access and inconsistent quality for the industry as a whole.

One area where this is most evident is with the lack of a standard for electronic medical records. It is estimated that the widespread use of electronic records by itself could save 20 percent of the total of all healthcare costs, reduce the alarming number of medical mistakes, and drastically improve the quality of the nation’s healthcare.[3] More widespread adoption of standard electronic medical records is a near-term (7-10 year) priority of the U.S. government.[4] But there are other innovations in IW technology on the horizon that can drive better outcomes, greater access and lower costs, and that are consistent with the priorities of the healthcare industry and its customers.

Requirements for Success

Every business needs tools that are matched to both its business requirements and the skills and practices of the end user, or information worker. Good, effective tools are those that provide easy access to data, processes and people, anywhere and anytime. In healthcare, where timely delivery of correct information can spell the difference between life and death, front-line workers place a premium on data that can be communicated clearly and succinctly using the simplest available interface, and is mobile enough to keep pace with the fast-moving clinical environment. This need for crisp delivery is such a priority that many in the healthcare field have stuck with tried-and-true "analog" tools such as the pen and clipboard, intercom, dictation device[5] and personal memory because of their simplicity and immediacy, despite the problems that these methods present for later collection, storage, retrieval and communication of data.

Any IT solution that aspires to replace traditional practices must conform first and foremost to the needs for simplicity, speed and portability. It is prohibitively expensive to take healthcare workers off the line of service to receive training in complicated software. Therefore, interfaces should be intuitive. Keyboard input is neither a comfortable nor a practical option in many clinical scenarios. Tools that allow natural input via digital ink, voice, touch-screen, or point-and-click better meet the requirements than applications that require key-entry only. Applications also need to run on mobile devices and must provide easy ways to connect or synchronize with central data stores.

Ease of use and access are not the only requirements. Many first-generation IT products for healthcare were based on closed, proprietary technology, accessible only through dedicated applications with difficult, inflexible interfaces. Today's solutions must be able to pull information from these closed systems and integrate it in meaningful ways. Newer architectures should be interoperable and interconnected, using open standards and a highly distributed model to share information in and between hospitals, clinics and physician offices. These also have to support office functions such as scheduling, insurance eligibility and billing, and in the future may need to support electronic prescribing.

The final requirement for success of IT solutions in the medical industry is low cost of ownership. There are many high-cost components of the healthcare system — for example, expertise, equipment and insurance — that are perceived as more central to the core mission of providing care than computers and software. Dedicated proprietary systems are beyond the financial reach of many physicians and small clinics, especially those engaged in primary care. But today, the IT tools that can drive better outcomes, greater efficiency and wider access for healthcare must be based on a proven, standard and affordable platform for information work — one that will also provide the speed, simplicity, mobility and interoperability that the industry demands.

IT Tools for Today's Healthcare Needs

Current tools based on software such as Microsoft® Office System InfoPath®, SharePoint®, Microsoft Office Live Meeting, BizTalk® and more are addressing many of the challenges of today's healthcare environment with:

- **Communication and collaboration,** including instant messaging (IM), e-mail, and rich application-sharing environments that diminish the need for travel and face-to-face consultations.
- **Mobility solutions** that fit the needs of real-world healthcare environments, and which take advantage of devices such as Tablet PCs, Pocket PCs and Smartphones to put information in a form that is conveniently accessible by healthcare professionals at the bedside or other point of care wherever and whenever it is needed.
- **Tools for better information management,** including form design (InfoPath), team workspaces (SharePoint), and presentation of data from closed legacy systems in better-integrated, user-friendly formats (BizTalk), including the accelerators for the Health Insurance Portability and Accountability Act of 1996 (HIPAA) and Health Level Seven (HL7).[6]

These products are available today and are delivering enormous benefits for customers in many critical aspects of healthcare, from clinical care to billing and compliance. A significant step forward from previous generations of Microsoft Office, these technologies provide unprecedented integration, capabilities and ease of use that enable integration partners to rapidly and cost-effectively build custom solutions for specific healthcare processes and customer requirements.

Toward the Future of Healthcare Information Work

As exciting and productive as today's solutions and applications are, they are only the first wave of a revolution in information work (IW) technology that promises to drive levels of care, efficiency and access to new heights, while freeing healthcare professionals to focus on their craft, their patients and their passion.

The connected, collaborative, mobile and integration features of today's tools form the foundation of the solutions of the future. To these capabilities, new technologies will add greater automation of low-value activities; smarter, simpler interfaces that can anticipate user needs based on clues inferred from context and observed behavior; improved security at a more granular level of data, giving individuals and organizations more control over sensitive information; ways to model and present complex data in real time; and features that capitalize on lighter, more powerful mobile devices, new form factors for digital devices, and new ways to interact with data in the physical world — all in an environment that protects patient privacy.

These capabilities will be based on emerging technologies such as pattern recognition, smart content, visualization, hardware innovations and metadata. Some may begin to appear as quickly as five to seven years from now as incremental updates to the standard information work platform. Partners and independent software vendors will incorporate them into industry-specific solutions with a likely adoption timeframe of 10 to 12 years.

In the fast-paced world of IT development, this may seem like a very far horizon. Indeed, customers faced with immediate resource planning priorities should not take the vision presented in this document as a promise or a road map for what is certainly to come, either from Microsoft or other vendors. Exactly how, when and in what form these capabilities will surface remains undetermined. However, they are areas where considerable research and investment are ongoing. Today, Microsoft is already planning for the days that these capabilities begin to bear fruit and is preparing for the many ways they will deliver benefits for healthcare customers, given the new challenges those customers are likely to face.

Future Needs, Future Solutions

Today's challenges are primarily around closing the technology gap in the healthcare industry and eliminating the wasteful practices that claim 50 cents of every healthcare dollar spent in the U.S. economy. In 10 years, it is likely that many of today's systemic inefficiencies will be addressed, and the focus will shift toward optimizing practices that are already relatively IT-centric with a goal of making them at once more pervasive and less intrusive, more secure and more transparent, and more available globally.

Larger social trends in 10 years form a backdrop to these industry-specific issues. Demographic data tell us to expect a rising population of older adults who are likely to place greater demands on the healthcare industry.[7] The "millennial" generation of the 1990s will be entering the work force, bringing with them the high expectations of a lifetime spent as consumers and students entirely in the digital world. Technology will fully support the globalization of information work, giving organizations and workers access to the market for skills and ideas, regardless of their

physical location or nationality. And the issues of security, privacy, intellectual property and use of information will still be with us — if anything, they will be even more present and more acute.

The healthcare industry of 2015 must be ready for these challenges. The next generation of IT tools for healthcare information workers must not only consolidate the gains of efficiency, information flow and usability offered today, but add new capabilities that fulfill these promises to the healthcare industry:

- **Improve quality and consistency of care,** best practices and "evidenced-based medicine"
- **Let doctors be doctors** by automating low-value administrative activities, freeing healthcare professionals to pursue the art and science of medicine
- **Provide greater transparency** for patients, clinicians, administrators and third-party payers while protecting privacy and confidentiality
- **Extend the benefits of world-class medicine** across the geographic and economic divide

Improving the Quality and Consistency of Care

Practicing medicine effectively relies on having access to timely and accurate information. But information is too often trapped in paper documents that are easily lost or misfiled, stuck in the database of a closed system that doesn't communicate with commonly used applications, or part of the informal knowledge of hard-to-reach experts. Today, leading-edge information-work technology is making it easier to discover information by consulting with colleagues and patients over time and space, or accessing integrated databases and the Internet. However, the healthcare professional remains the primary "search engine" and point of integration for all this data, because the data itself often lacks the context necessary to make it meaningful and valuable.

New developments in information-work technology are making it possible to move from discovery of information to anticipation by becoming smarter and more context-sensitive. The idea is to automate more and more of the search and retrieval activities that consume so much of the time of healthcare professionals, giving them more time to focus on the inferences and judgments that only they are qualified to make, while ensuring that the best, most timely information is always delivered where and when it is needed most.[8]

Find Relevant Information Faster

Today, the problems of searching through multiple file systems and formats and trying to document the skills and practices of experts to ensure consistent care are being addressed through IT platforms such as Microsoft Office System products and services. More data is being captured in digital form, and better tools are available to convert old information to standard formats. With wider adoption of electronic medical records and the centralization of siloed data into unified repositories, the old challenges of searching may diminish, but they are certain to be replaced by new ones.

Navigating databases and forming queries to produce relevant results remain a challenge, as any user of popular Internet search engines can confirm. Sorting useful information from noise is something that humans still do much better than computers. We can tell at a glance whether a particular e-mail message is urgent, whether a search result is germane to the task at hand, or whether a document contains reliable information. There isn't necessarily a single rule or set of criteria we apply, but we rely rather on an adaptive and highly intuitive process of inference based on clues such as the source of the information, the date, who else was included on the e-mail thread, and what else we're doing at the time: In short, we rely on the context to determine the usefulness of information.

Pattern recognition technology, based on advanced statistical algorithms that simulate human decision-making processes, will make the next generation of information-worker tools much more context-sensitive in a number of ways.[9] In terms of information search, the application will automate many of the mental steps that workers themselves must now perform. What folder did I put that file in? What documents do I need for my 1 p.m. consultation? Is this blood test the most current? The results of these new technologies will be greater speed and better quality of information, enabling healthcare workers to base their decisions on the most solid foundation of data.

Easily Locate Experts

This process of adaptive filtering via pattern recognition provides the first layer of simplification and efficiency to information management. But often, even well-chosen documentary information is not sufficient to answer the question at hand. The people who authored, reviewed and handled the documents can provide a critical part of the story necessary to take action.

In the past, locating the right people involved making phone calls, leaving messages and waiting to hear back. At best, the process was uncertain and informal; at worst, there was simply no way to identify authorship of documents, who made changes, or how the document ended up in its current location. Even digital documents sometimes have this problem.

“Smart documents” provide the solution. Smart documents are “smart” because they contain metadata that dynamically tracks authorship, user rights, chain of custody, tags to assist in search and retrieval, and embedded applications to handle special functions (such as decoding a compressed MRI image).[10] Author information embedded in the document will communicate with collaboration applications such as contact managers, e-mail, instant messaging, telephony and presence detection. This way, anyone who accesses a document not only has the information necessary to follow up with the author, but also has the necessary information to determine whether the author is available immediately to respond to questions.

Spread Best Practices Faster

Evidence-based medicine promises to deliver greater consistency of care by giving doctors access to the best and latest knowledge and experience of their peers. But even the most conscientious medical professionals are challenged to keep abreast of the rapidly proliferating knowledge in their field, including the track record of new techniques and therapies.[11] When relevant documents associated closely with human expertise don’t provide sufficient context for decision-making, the final test for information accuracy and reliability is, “How useful was this to my peers in a similar situation?” This level of information will be visible to information workers via reputation systems for data and people. Today’s reputation systems are often manual — checking a box at the end of a knowledge-base entry that asks, “Did this answer your question?” or filling out a user-feedback form in a forum such as eBay. As these systems become more sophisticated, they will also become more transparent and more pervasive. By dynamically tracking the use of data, the outcomes of person-to-person interactions, and the effectiveness of practices, reputation systems will push the best resources and processes to the surface quickly and automatically, ensuring the rapid spread of consistently good-quality information and the fast weeding-out of the useless and irrelevant.

Access Real-Time Patient Data

Giving healthcare information workers better tools to navigate in an information-rich environment is one way to drive improvements in quality and consistency of care. Providing new and better streams of critical information in real time is another. Advances in miniaturization and nanotechnology are driving the development of microscopic devices that can collect and

communicate information using radio frequencies. Radio frequency identification (RFID) chips — tiny transmitters that broadcast a data signature to land- and satellite-based receivers — are already coming into service to track physical inventory. Many in the medical community are also looking at ingestible or implanted RFID devices[12] to provide rich real-time information on patient health, monitor the quality and regulate the release of medication,[13] identify the history of surgeries,[14] and communicate with other IT devices in inpatient or outpatient environments to reduce errors, assist nurses and clinicians, and provide data for more accurate diagnosis and treatment.[15]

RFID or related technologies have the potential to introduce dramatic new efficiencies in patient care. A single nurse can monitor the status of patients on an entire ward with precision and real-time responsiveness from one workstation. Subcutaneous RFID devices for patients could communicate with similar devices embedded in medication labels to alert caregivers to potential allergies or errors in dosage, frequency or interactions. Outpatients could be monitored remotely, with care dispatched automatically in the event of an emergency.

Enable Individualized Therapies

One more area where new information work tools have the potential to open vast new possibilities in quality of care is in personalized treatments. Over the next 10 years, the kind of sophisticated applications and computing horsepower that enabled researchers to sequence the human genome and advance medical science through genomics and proteomics will come within reach of mainstream providers, small labs, clinics and pharmacies. New systems that enable computers to pool processing power over networks via distributed computing (as the Search for Extraterrestrial Intelligence (SETI) project does today over the Internet)[16] will enable information workers to model and visualize extremely complex data sets using everyday applications bundled in the commodity information work tool set. The migration of these tasks from highly specialized and expensive systems to the standard information work platform will bring the promise of individualized therapy within reach and create new high-value IW roles for mainstream professionals.[17]

Letting Doctors Be Doctors

It's often joked that "no one goes into medicine for the paperwork," but paperwork and other low-level tasks compose a significant portion of most healthcare professionals' daily routines. Nurses spend only 25 percent of their time engaged in face-to-face patient care; the bulk of their time is administrative or information-seeking.

E-mail, IM, the Internet, electronic forms and other current-day technologies can dramatically reduce the volume of actual paper and improve control over information. Their wider adoption in the healthcare industry will doubtless produce many needed efficiencies. But each of these technologies also brings with it new practices that can add complexity and potentially replace one set of administrative chores with another. Smarter, more adaptive IW tools can help break the cycle of escalating complexity and substantially reduce the time healthcare workers spend managing, finding, routing and prioritizing information. Relieved of this burden, they will be free to bring their expertise and judgment to bear on tasks that can't be automated, and practice the art as well as the science of medicine.

Reduce Time Spent on "Inbox Triage"

E-mail and IM have revolutionized communication, but both cease to be a convenience when the volume of incoming e-mail exceeds the limited time and attention that professionals have to devote, or when constant interruptions disrupt normal work habits. Spotting and prioritizing incoming messages is another intuitive task that humans currently do much better than machines.

Most of us don't need rules or filters to know spam when we see it, and we know to reply later (if at all) to the daily joke from Uncle Marvin but to give immediate attention to a memo from the boss. This process of triage may be quick and easy, but each decision demands an instant of our time and may distract us from tasks requiring focus and concentration.

Adaptive filtering based on machine learning and pattern recognition will soon be able to automate a great number of those trivial decisions by using a combination of rules and "training" to assign priority to incoming messages, automatically formatting and routing them to the appropriate device, and interrupting the user only when necessary. In this high-tech game of "Clue," personal communication software would know to page Dr. Blue on her cell phone in the library, send the X-rays to Dr. Green on the video display in the examining room, and pull the files on Colonel Mustard for his 2 p.m. appointment scheduled in Dr. Gray's calendar.

Gain a Clear Window on Critical Information

In many healthcare scenarios, the crisp, easily comprehensible display of information is essential for caregivers making split-second critical decisions. Interfaces that are counterintuitive, complex, cluttered with confusing features, or hard to read can be worse than useless in critical situations. At the same time, good applications need to provide a wealth of information as needs shift. This ability to provide feedback across a range of subjects at the appropriate level of detail and clarity is second nature to most people because our "interface" (the brain) understands how to adapt to context. Many computer applications allow users to customize the way information is presented or what buttons and features are visible on the screen, but this is a static rather than dynamic process, and is often a feature buried deep in the menus of the software.

Using pattern recognition and machine learning technology, the next generation of IW applications for healthcare will feature adaptive interfaces that provide clearer, simpler access to relevant information without the need for the user to learn complex features or continually reconfigure the applications depending on the circumstance.[18]

Spot and Eliminate Process Errors

Process exceptions or errors can gum up or derail structured workflow, resulting in delays, redundant services, unexpected outcomes, and costly and time-consuming rework. It doesn't take most people long to spot a misfiled document, an abnormal data point or a broken process when they see one. But computers usually can't spot a problem within a structured process unless given very specific conditions. In fact, many applications will repeat or propagate the error (e.g., a duplicate record in a database that's off by one letter) until something happens to bring it to the attention of a human operator (e.g., the customer complains about receiving duplicate mailings). Applications are also unlikely to notice process failures that lie outside closed systems — for example, a wrong telephone number listed on a Web site causing a zero response rate.

Emerging IW tools will take a more holistic view of workflow, providing data and metrics on highly specific activities to make it easier and faster to spot points of failure. Smarter workflow tools will use pattern recognition and "preponderance of evidence" logic to learn to identify process exceptions with fuzzier edges (anomalous test results indicating lab error, repetitions of the same process errors) and route them to the right place for resolution. This can considerably reduce the frustration, lost time and error rate resulting from misfiled forms, duplicate patient information in databases, misrouted test results, and similar systemic breakdowns.

Interact With Computers on Your Terms

For many healthcare professionals, the biggest barrier to accessing information on computers is the keyboard. Keyboard entry is optimized for a certain kind of information work, but is ill-suited for the fast, mobile, no-hands style required in clinical environments. Tablet PCs, Pocket PCs and

Smartphones provide wider input options to capture handwritten notes, forms and voice memos in digital format.[19] New options for data input will make it easier and more natural for healthcare professionals to interact with information systems. These include natural language and speech recognition for data input and instructions (including real-time translation tools to facilitate international collaboration) as well as dictation and automated transcription, biometric authentication for security and single sign-on, digital motion-capture tied to surgical instruments, "smart" medical environments that can record and adjust environmental conditions, and more.

Enabling Transparency, Protecting Privacy

Patients, healthcare providers, third-party payers and the government all want greater visibility into aspects of the healthcare system to maximize quality, ensure fairness, and speed the adoption of best-practices that can result in better outcomes and lower costs. At the same time, keeping patient information confidential and secure has been one of the major stumbling blocks in the adoption of networked IT solutions for healthcare and public health. The combination of smarter and more trustworthy information work tools will provide effective solutions to these challenges.

Control Access to Content at a Granular Level

Maintaining control over who has access to documents is a problem that is only beginning to be solved. Office 2003 includes Information Rights Management (IRM) features that enables document authors and system administrators to set permissions on access and transfer of documents, grant and revoke access, and set rights to automatically expire on specific times and dates. This is an enormous step forward in the protection of intellectual property and confidentiality.

However, current IRM schemes work only at the document level. Prudent security measures dictate that documents containing any potentially confidential content should be rights-managed, even if the vast majority of content in the document is entirely suitable for public consumption. Organizations that face transparency or compliance requirements that force them to walk a fine line between confidentiality and disclosure have the choice of allocating resources to tightly manage IRM policies, or to maintain parallel versions of documents in a public and private form.

Evolving IRM technology will address this challenge by enabling rights management of content at a more granular level. Individual words, lines or paragraphs of documents, cells and formulas of spreadsheets, fields in data records, or slides in a PowerPoint presentation could be tagged as hidden to users who lack proper security credentials. This will enable the maintenance of a single document for public and restricted audiences, and a single set of IRM policies that operate transparently to end users by relying on credentials implicit in the user's identity management profile.

Because the IRM metadata (along with other metadata useful for search, audit-trail, presence, and decoding of data types) travels with the content segment rather than the entire document, new documents could be easily and automatically assembled from tagged components, either ahead of time or dynamically by role-based rules, with global IRM policies already set based on their component policies.

In healthcare, this means that providers, administrators, payers, regulators and patients could all have access to the same basic set of documents, but would have different views of those documents based on their role needs and security level. Reports assembled from documents with confidential content would auto-redact the content segments that compromise privacy or security without the need for administrative intervention. And individual fields of medical records could be easily shared for research or compliance purposes without disclosing private patient information.

Better, more flexible IRM at the document level also has applications in the development and maintenance of policies and procedures. Better IRM tools will not only allow facilities to replace the unwieldy paper binders that are the usual repository of policy and procedure information, but also to maintain control over content much more efficiently. By applying IRM at the document level, administrators will have control and visibility over who can edit and add to documents by section, sentence or word. Smart documents linked to back-end systems for document life-cycle management will also ensure that changes and updates are automatically propagated to every appropriate location, even blocks of text from the master documents that have been incorporated into other content.

Better Security Without Passwords

Password-based security regimes impose a substantial burden on information workers. Because individual applications, records and sites often have their own identity-management subsystems, and sessions timeout quickly to prevent abuse, users are frequently prompted to supply credentials consisting of hard-to-remember combinations of characters that need to be changed frequently. Information workers who take the obvious step of writing down their passwords and keeping them handy (either as sticky notes or on a sheet of paper near their desk) risk compromising the security of the system in exchange for convenience.

Today we are seeing the first wave of adoption of biometric authentication systems that use hard-to-spoof evidence unique to the individual user, such as fingerprints, facial recognition, voice prints, typing patterns, handwriting and retinal scanning. Because of their convenience, simplicity, security and falling price as they reach commodity status, biometrics will play an increasingly prominent role in the security and privacy policies of future information work tools. As these tools evolve, authentication will become less of an explicit declaration of credentials (e.g., providing user name and biometric). Instead, applications will gather biometric information implicitly in the course of routine interaction with the system and use pattern recognition that relies on a preponderance of evidence to authenticate users without intruding on their workflow.[20]

Identity management is already being unified at the platform level, as in products like Microsoft Windows Server™ 2003 and forthcoming releases. The next 10 years are likely to see the adoption of standards across applications and platforms to enable single sign-on (SSO) and persistent session states not only across the enterprise, but also between organizations and over public networks.

Implicit authentication and unified identity management combine to offer the convenience of quick, easy and secure single sign-on to a complete, systemwide profile for healthcare professionals as they move from station to station, or from a mobile device to a desktop. The results will be greater security and systemic integrity with fewer if any cumbersome requirements to inconvenience information workers using the system.

Support Transparency and Compliance

HIPAA, state, local and international regulations are driving IT spending in the healthcare industry, as organizations seek to meet requirements for data security, system integrity and auditability. For organizations with older, less flexible IT infrastructures, this means considerable investment in technology that specifically addresses compliance mandates — investments that may add considerably to the complexity of their systems and impose burdensome new practices on IW end users.

Microsoft today offers customers convenient and effective compliance solutions in the form of the Microsoft Office Solution Accelerators for HIPAA and HL7. As the healthcare industry moves toward more open and flexible IT systems, applications will include standard capabilities that enable compliance with specific regulations, along with the flexibility to meet new challenges at

lower incremental cost, and in ways that are transparent to information workers and system administrators. These capabilities may include nonintrusive data-mining tools that automatically archive e-mail systems, IM and application-sharing sessions to support compliance audits, provide forensic data in the event of litigation, or enable a detailed review of practices at a granular level to improve efficiencies.[21]

Demystify Healthcare for Patients and the Public

Transparency creates trust. Currently, many people with direct and indirect contact with the healthcare industry are mystified and frustrated — not just by the irreducibly complex nature of medical conditions and treatments, but also by the very basic and routine practicalities of finding the right provider, understanding costs, scheduling appointments, and making sense of healthcare-related news reported in the media.[22]

Today, healthcare information is spread through the most informal and unpredictable of channels: word of mouth, anonymous or unreliable Web sites, and the deceptive claims of self-interested parties. The set of technologies broadly labeled “social networking” can address the problem of information flow and transparency by providing greater predictability and rigor to decentralized communication channels.[23]

Social networking applications in use today allow users to create and manage communities of interest (or communities of practice), publish information to blogs and group sites, and link to sources of information of interest to group members. Currently, however, these communities depend on the efforts of administrators to manage memberships and moderate content. They also require prospective group members to seek them out.

The application of pattern recognition to social networking reduces both of these pains. Pattern recognition can be used to filter content based on context, history and reputation of the author and manage routine administration tasks without the need for extensive intervention. It can also be used to evaluate the relative value of person-to-person or group interactions, based on the volume of discussion that specific threads or participants generate, and commonalities between the profiles of users who end up communicating and collaborating more extensively. Combined with reputation systems that allow users to rate the quality of content, sources and participants, smart social networking systems can proactively connect each community member with the people and information most likely to be useful to them, and can even suggest communities for users to participate in.

This enables patients and healthcare professionals to form, manage and participate in communities of practice and virtual support groups with a higher quality of content, greater visibility, and greater integrity of information on medical issues than is available today. It can also provide rich and direct channels to give patients access to their “personal health record” and information that will be needed if consumers are expected to become wiser purchasers of healthcare.[24]

Extending Access to World-Class Healthcare

The economics of healthcare in the United States and worldwide have led to inequalities in the provision of care, rationing of healthcare resources (either by government mandate or by market forces), and stresses to providers, patients, payers, hospitals and nearly everyone involved in the system. These distortions are especially acute in the case of emerging economies, where desperately needed resources and expertise are severely limited.

It doesn't have to be that way. The efficiencies and capabilities of a new generation of IW technology for healthcare can help close these gaps by driving down costs and extending the reach and capabilities of healthcare providers over time and space.

Support Communities With Limited Medical Resources

Communities with scarce resources, few or poorly trained (or no) doctors, and inadequate facilities urgently need to find ways to stretch the capabilities they have to serve the largest number, while allocating the limited time and attention of healthcare professionals to the patients who require them most. Some acute conditions require the personal attention of a caregiver. But routine problems can often be solved or prevented by dispensing information. In areas where medical skills are in short supply, technology can help close the gap.

The emerging technologies of machine learning, pattern recognition and data mining can assist in diagnosis and provide treatment options for common conditions. These systems would support natural-language queries and use automated, context-based searches to determine the best approach for each patient. Simplified interfaces (such as voice or touch screen) will make them easy and accessible for all users. These could be deployed as aids to providers with minimal training, or as self-service resources for patients via the Internet or public kiosks.

Leverage Mobile Solutions to Leapfrog Over Infrastructure Gaps

Many of the poorest countries and regions have nearly no infrastructure to support even the most basic of IT solutions. As it happens, the falling price and increasing availability of mobile and wireless devices is allowing some of these places to skip the previous generation of infrastructure — such as land-based phone lines, desktop computers and older software applications — and leap immediately into the new age of connected mobility. As form factors for computer hardware proliferate into smaller, lighter and purpose-built equipment, and as battery life for these devices increases, some remote regions may be far better served by highly mobile teams of healthcare providers than by stationary facilities.

Enable Remote Medicine

One of the main barriers to more equal access to medical resources is that the ability to deliver care presupposes the physical presence of a healthcare worker. Because professionals are scarce and unevenly distributed, so is access to treatment. Already, technologies that enable rich remote presence (voice, video, data and application sharing in real time), such as the Microsoft Office Live Meeting service, are lowering that barrier by making medical expertise potentially available anytime, anywhere. These services support scenarios such as remote consultations between doctor and patient, consultations between healthcare professionals, and online symposia that enable the sharing of information and practices across the profession and the world, and at dramatically lower cost than traditional face-to-face methods.

Moving forward, these remote experiences will be supplemented by telepresence that extends the reach of physicians — literally. Technology is appearing today to support virtual operating theaters, where doctors can perform procedures remotely, using natural-gesture interfaces to control servo-operated instruments while monitoring conditions in real time over a network. Similar technologies could also be used to enable doctors to collaborate on procedures in real time from remote locations. The motion data captured by these applications can also be stored and used to recreate procedures through visualization. These recreations and simulations could assist in training the next generation of healthcare professionals in vivid and detailed ways, preparing them for the medical challenges ahead.

Provide Tools for Public Health and Epidemiology

Many health threats, from preventable conditions to epidemics and the grim prospect of bioterrorism, require responses at a higher level than doctor-to-patient. Healthcare professionals on the front lines of these types of issues need to work closely with colleagues in research and public health and safety agencies to exchange information, so as to contain threats quickly and limit danger to the public. Communication and collaboration technology currently in use, such as e-mail, listservs, and directory services for health officers and first responders, along with alternative methods of contact (e-mail, pager, fax, wireless, instant messaging) and team workspaces enable the aggregation of expertise to quickly develop effective solutions. Public health law requires these interactions, and funding for these requirements is included in the U.S. bioterrorism and homeland security budgets.

Soon, integration of pattern recognition technologies with geographic information survey (GIS) and epidemiological data will help healthcare professionals, researchers and public health officials quickly identify the outbreak and spread of communicable diseases, predict high-risk scenarios, enable the formulation of effective countermeasures, and propagate that information directly to healthcare workers on the front lines. Syndromic surveillance — identifying trends in a variety of health and social data — is already in use for this purpose.[25]

In addition, access to the electronic health records (EHRs) of entire populations — rights-managed to rigorously protect individual privacy — will enable researchers to gain new insights on genetic and environmental causes of particular conditions. Simulation, modeling and visualization capabilities built into the commodity IW application suite will give mainstream workers the tools to work with this data, bringing new insights to the surface and speeding the pace of innovation.

Making the Vision Real

From today's vantage point, the healthcare industry faces a steep climb toward the productivity gains and efficiencies promised by IT solutions that are available now. Promoting the widespread adoption of a standard electronic medical record alone will require an investment of hundreds of billions of U.S. dollars. Other useful standards around interorganizational collaboration, IRM, SSO, etc., will require comparable commitments. It may be a decade at least before these gains are realized industrywide in a meaningful way.[26]

Organizations facing this kind of commitment can be excused for having some trepidation about the impact of all this new technology on an industry that has heretofore run predominantly on human expertise. How will new information-work software and the practices associated with it affect the ability of doctors, nurses, staff and administrators to do their jobs? Will busy professionals have to learn daunting new skills and adapt to uncomfortable new procedures to realize the productivity and efficiency benefits that are so urgently needed in the system?

These are reasonable questions, considering the cost and complexity of previous generations of IT solutions, especially in healthcare. The purpose of this paper is to point out the ways in which IT tools for healthcare information workers are converging in the direction of the workers' natural skills and practices, giving people the tools to manage effectively in a complex environment while burying the complexity under layers of smart, anticipatory applications and automation. IT is a partner with healthcare workers and the healthcare industry, driving toward a common purpose: not just lower costs, but better quality of care, greater transparency and security, and increased access — all delivered in a way that is familiar, easy and useful to healthcare providers.

Microsoft's vision for the future of information work in healthcare is to do the following:

- Enable information workers to spend more productive hours applying their skills and craft to problem-solving, not low-value rote work such as search, filing and transcription

- Help information workers feel empowered and in control of their time and information, not controlled by it
- Make collaboration and communication with colleagues as natural as working alone
- Deliver software for information workers that is a transparent enabler of the expression of ideas and insights, not a challenge that needs to be mastered in itself

Many of the scenarios and examples discussed in this paper are in the early phases of adoption today. Others depend on the development of enabling technologies, which will then find their way into applications and solutions closer to the far end of the 10-year horizon.

Microsoft is committed to realizing this vision and its benefits for patients, the healthcare industry, and the overall economy by moving rapidly toward the development of smart, simple, pervasive and trustworthy IW tools that bring these capabilities to market in integrated and affordable software solutions. Microsoft has already taken the first step with the Microsoft Office System. Together with system integrators and partners, many healthcare organizations today are achieving enormous efficiencies, greater productivity and, best of all, better outcomes by using the tools available now.

Microsoft's strategy is to build the capabilities that enable the vision described in this paper into the proven and familiar Office tools that information workers use every day, providing a seamless transition from today's world of connected productivity to a new world and new possibilities for the healthcare industry.

Endnotes

1 Sagar, Alan and Deborah Socolar. “Healthcare Costs Absorb One-Quarter of Economic Growth, 2000-2005.” Boston University School of Public Health, 2005.

2 Havenstein, H. “Electronic Health Records Slow to Catch On.” Computerworld, Feb. 22, 2005.

3 Terry, Ken. “Exclusive Survey: Doctors and EHRs.” Medical Economics, January 2005.

4 United States Department of Health and Human Services, Office of the National Coordinator for Information Technology. “Goals of Strategic Framework.”

5 Physicians are so used to “dictating” that they often measure IT solutions against this productivity standard. Of course transcribing their dictation is very expensive, 10 cents to 15 cents a line or more, and the typical hospital spends hundreds of thousands of dollars on transcription services. Transcription costs are also a major source of overhead in many physician offices and group practices. And although dictation itself is fast, getting the information into a chart often causes delays, and the information itself isn’t structured, which makes it fairly useless for data analysis, etc.

6 See Microsoft case studies, including “New Mexico United Multiple Agencies with Cost-Effective HIPAA Solution,” January 2003. This and others can be found at the Microsoft government solutions Web site at http://www.microsoft.com/government.

7 Curry, T. “Elderly to put ‘phenomenal’ pressure on budget.” MSNBC, Jan. 25, 2005.

8 Lamonte, K. “How KM Can Help Cure Medical Errors.” KMWorld, Content Document and Knowledge Management, Volume 14, No. 2, Feb. 2005.

9 One interesting example of pattern recognition for diagnosis and disease modeling is described in Matej Oresic, et al., “Towards an Integrative and Context-Sensitive Approach to In Silico Disease Modelling.” http://www.ercim.org/publication/Ercim_News/enw60/oresic.html. Katherine Adams provides more generalized examples of machine-learning and context sensitivity for enterprise search in “Extracting Knowledge: Artificial intelligence tools offer new ways to explore Web content,” Intelligent Knowledge Management, January 2005, http://www.intelligentkm.com/feature/010507/feat1.jhtml?_requestid=7622.

10 XML-based Smart Documents are already beginning to be used in some enterprise applications. However, the overhead associated with designing and implementing the current technology adds daunting costs and complexity. See K. Gilhooly, “Documents Get Smart,” Computerworld, November 2004. Innovations in pattern recognition and machine learning will eventually drive greater automation and simplicity into the processes for tagging unstructured content.

11 A. Galijins et al. “Evidence, Politics and Technology Change.” Health Affairs, Vol. 24, Issue 1, 29–40, January 2005.

12 M. Kanellos, “RFID Tags may be implanted in patients’ arms.” CNET News, July 28, 2004.

13 “RFID Use urged for Pharmaceutical Industry.” ECT News, Feb. 2, 2005.

14 “FDA Clears New Surgical Marker, Uses RFID to Protect Patients.” Medical News Today, Nov. 20, 2004.

15 See “RFID In Healthcare – a Panacea for the regulations and issues affecting the industry?” UPS Consultants, 2004.

16 The SETI Institute (the Search for Extraterrestrial Intelligence) uses the processing power donated by tens of thousands of idle computers linked via the Internet to perform extremely complex pattern analysis on data collected from listening stations tuned to receive radio frequencies from space. More information is available at http://www.seti.org.

17 In this case, the technology issues seem somewhat more clear-cut than the ethics. For a balanced perspective on this question, see “Testing Times,” The Economist, Oct. 19, 2000.

18 “Smart,” “personalized” and “adaptive” interfaces are already used in many portal applications, which apply rules and identity-management information to create custom views of enterprise data on demand. Next-generation applications will extend this functionality by using contextual assumptions and machine learning to learn and anticipate user requirements.

19 Uptake on these technologies in healthcare has been rapid. According to Skyscape Psychiatry PDA Usage Survey, April 2004, “A new survey released today at the American Psychiatric Association’s 157th Annual Meeting shows significant results about psychiatrists’ increasing reliance on their handheld computers (PDAs) and their impact on daily activities. More than 64 percent of the survey respondents use their PDA more than four times a day, with 12 percent using it more than 25 times a day. Some of the most useful PDA references for psychiatrists are gold standard clinical references, such as DSM-IV-TR, drug references and drug interaction guides — with over 71 percent of survey respondents crediting PDAs with helping them reduce medical errors.”

20 An application of context-sensitive pattern recognition for more transparent security and privacy in healthcare applications, with or without a biometric component, is discussed by Hu and Weaver, “Dynamic Context Aware Access Control for Distributed Healthcare Applications,” University of Virginia Department of Computer Science, 2004.

21 These knowledge management archiving solutions are useful in many ways, including preservation of institutional learning and the ability for future users to browse through entire discussions in context to fully understand issues and intentions. See Kontzer, T. “Content Overload,” Information Week, January 2004.

22 Greengard, S. “The Hospital of the 21st Century.” Cisco Systems, 2003.

23 It’s often said that people give more thought to buying a refrigerator than they do selecting the medical provider in whose hands they are placing their life. They also probably can get more information about the refrigerator (from sources such as Consumer Reports) than they can on their doctor.

24 One in four American adults has searched online for information about prescription drugs. Twenty-six percent of American adults have researched prescription drugs online — 21 percent have personally done so, and 5 percent have had it done for them by someone else, according to the Pew Internet & American Life Project. “Prescription Drugs Online: One in four Americans have looked online for drug information, but few have ventured into the online drug marketplace,” October 2004.

25 One example is the work being done at the Public Health Informatics Group at the University of Washington. See http://phig.washington.edu for current information.

26 Brailer, David. “Interoperability: The Key to the Future Healthcare System.” Health Affairs, January 2005.