Tables in Marinaccio's restaurant were full one evening last spring as health-care professionals from around the city gathered for a Buffalo Academy of Medicine meeting featuring two speakers invited to talk about the Western New York Health Information Project.

During the salad course, Arun Vishwanath, PhD, assistant professor of communications at UB, presented preliminary findings from work he is conducting for the academy on barriers to adoption of information technology in medical practices.

Atif Zafar

MACRO *Manager*

BY
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ATIF ZAFAR, MD '94, PONDERS THE BIG-PICTURE ISSUES IN HEALTH INFORMATICS

At the conclusion of Vishwanath's talk, the next speaker began setting up his laptop while the wait staff cleared plates from the tables. Concerned that the clatter and bustle in the room would distract the second speaker, the program's moderator, Sanford H. Levy, MD '86, announced that there would be a brief break while dinner was served. The presenter demurred, cheerfully insisting he would prefer to begin his talk since he "had a lot to cover."

The speaker was Atif Zafar, MD '94, associate professor of medicine at Indiana University School of Medicine and a medical informatics expert who in 2001 received the prestigious George W. Thorn Award given to UB graduates under the age of 40 who have made outstanding contributions to their career field.

Over the next hour, Zafar took his audience on a whirlwind tour of today's health-information technology landscape, clicking on or skipping over dozens of slides and hurrying through others in a presentation he said usually takes him half a day to make. Concise and practiced, Zafar is a man on a mission who travels around the country, talking to people about what to expect as the full potential of information technology merges with the day-to-day realities of practicing medicine.

This stop in Western New York was special, however, because he was home.

Zafar was born in Pakistan and lived for a number of years in Libya before his family moved to Amherst, New York, where he spent his formative years.

His mother, Syeda Fazila Zafar, MD, is an anesthesiologist who practices at Millard Fillmore Hospital in Buffalo, and his father, Ismail, is a professor of physics at Daemen College. His two sisters are physicians: Mona Zafar, MD '01, is a pediatrician in Boston, and Faiza Zafar is an internist in Seattle. His brother, Khurram, is a Silicon Valley quality control expert in chip fabrication.

"What health-information technology is all about is delivering the right information to the right person in the right format at the right time with the right level of urgency," he says during a conversation a few months later while back in Buffalo to meet with the chief information officers (CIOs) of the seven institutions that operate Western New York's *Healthenet.

On this trip, he is traveling in his capacity as a consultant with the Agency for Healthcare Research and Quality (AHRQ), National Resource Center for Health Information Technology, located at the Regenstrief Institute for Healthcare at the Indiana University School of Medicine.

The Healthenet consortium has a grant from AHRQ (pronounced "ark") to further its planning work, and Zafar has come to discuss with the CIOs what he calls "cultural issues"; in particular, how to involve the Buffalo medical community in a proposed electronic health-information exchange that would make aggregated lab results available—the next stage in building a clinical-exchange network that until now has been limited to sharing eligibility data.

Removing Barriers to Quality Care

Zafar's path from the UB North Campus in the late 1980s to the conference room at Roswell Park Cancer Institute, where he met with the Healthenet CIOs, ran on two tracks.

As a UB undergraduate, he double majored in biology and mathematics, while spending a lot of time hanging around the Department of Computer Science and Engineering.

His first year in medical school, he participated in the annual Medical Student Research Forum, completing a project that involved computerized visualization of the development of scoliosis. His entry was awarded top honors.

The following year, he worked with a UB team on the morphology of the femur to see how hip implants could be improved by looking at the biomechanical properties of the bone.

At the time he owned an Apple Newton, the first consumer device to show the potential power of handwriting for data entry, something that would later figure in his professional interests. "I still have it at home," he says. "It's a relic now."

While completing residency training in internal medicine at the University of Cincinnati, he helped maintain and improve computer-aided teaching systems, during which time he acquired his first personal digital assistant (PDA). His program director suggested that he consider a fellowship at Indiana's Regenstrief Institute in Indianapolis, one of the pioneers in medical informatics. He visited the campus, liked what he saw and has been there ever since, now as an affiliated researcher.

Depending on the day of the week, Zafar is a clinician, an educator, a researcher or a consultant, but he refers to himself as an "informatician," a term that captures—and drives—the underlying theme behind all of his work: information.

As every other clinician does, he uses information he gathers from patient histories and lab results to devise and monitor treatment plans for his patients. But unlike most of his clinical colleagues, he spends the majority of his week thinking about that information in the abstract: how to move it where it needs to go, how to frame it, how to apply it, and how to check and correct it—exercises, which, in their composite, define the science of medical informatics.

When he opened his presentation to the Buffalo Medical Academy (his basic Health Information Technology lecture), Zafar posed the following question to his audience: "What is wrong with health care?"

From an informatician's perspective, it's the absence of effective information management and inter-provider communication in an environment of fragmented health-care delivery.

Some of the consequences of information mismanagement include: duplicate testing, uncoordinated drug prescriptions, haphazard documentation, and delayed, inappropriate or unnecessary care.

Solutions to these woes won't to be found in medical science, says Zafar, because the problems don't arise from lack of knowledge; instead, the answers will come from information science.

The hopeful news, he adds, is that health-information technologies are slowly making their way into medical practices, following on the heels of business management technologies that are now ubiquitous in medical offices. Some of these inroads include electronic medical records, communication systems that support health-information exchanges, and data repositories for aggregating medical information such as lab results.

In today's health-care market, Zafar observes, about one-third of physicians are "evangelists" for health-information technology in medical practice, about one-third are watching but waiting to jump in, and the final third are not interested. He expects to see movement in the upper two-thirds in the next few years, with more physicians coming off the sidelines.

This movement from watchful waiting to committed participation is something Zafar is doing his part to hasten, because he knows the outcome is so tantalizing: comprehensive, integrated data about a patient available to a provider, updated to the moment, on an easy-to-read electronic screen (tablet or slate), *anywhere*. This data would include such things as current lab results, history of lab results, patient history, diagnosis, notes from specialists' visits, results from tests ordered by specialists, treatment during hospitalization, orders upon discharge from the hospital, and current medications.

Zafar knows, however, that building the bridge from where we are today to where we could be tomorrow will be no small project. In fact, he cautions that it will not be a single project at all, but rather tens of thousands of projects gradually taking shape in practices and hospitals across entire regions.

Through his consulting work with AHRQ, Zafar is at the forefront of efforts to envision, design and build this bridge. AHRQ is the arm of the Department of Health and Human Services charged with federal leadership in this area. The agency's primary function is to provide grants and consulting resources for health-information technology projects around the nation and to create standards and infrastructure that will support adoption of the technologies. In addition to his role in AHRQ's national resource center, Zafar is also involved in another of the agency's projects—also administered under contract by Regenstrief—to promote practice-based research networks (PBRNs).

While all these large-scale efforts are essential, Zafar-the-physician never loses sight of the fact that, ultimately, the solutions he and others are looking for will be built upon a solid, hands-on understanding of the intricacies of medicine as it is practiced in today's complex health-care environment.

Theory Grounded in Practice

In his clinic at Indiana University's Wishard Hospital in Indianapolis, Zafar uses a paper chart backed up by a computerized provider order entry (CPOE) system. He prepares to see a patient by reviewing an encounter form: a printout in the paper chart that lists diagnoses, vital signs, and any upcoming screening interventions required for the patient, as well as special guidelines or reminders about the patient. He reviews his old notes and then pulls up a relevant visit history on his computer to see if the patient has been to the ER and if any test results have come back. He writes down these updates and takes the paper chart into the examination room.

After the encounter he goes back to the physician work area and types his notes into the computer, along with any orders (tests, medications, return visits, patient handouts,

and instructions) and signs them electronically. The system prints out prescriptions and test requisitions, which automatically go to the checkout desk, where staff give them to the patient.

Zafar also works half a dozen shifts a month as a hospitalist at Indiana University's Methodist Hospital, a setting where, by contrast, he writes his orders by hand and leaves them with a clerk to type into a computer system.

"In an ideal world, I'd like to see us putting orders in the computer so that we get some decision support and feedback," he says.

Such a system, he explains, could advise the provider of less expensive alternative medications, signal that a particular lab result is abnormal and should be repeated, or warn that a medication may conflict with another the patient is taking—information that has real value for patient care if it can be delivered to the provider at the moment the order is entered.

If Zafar were to build his own clinical health information system, tablet PCs would be his interface device of choice. A health IT system, he explains, consists of four component areas: applications (the software that performs tasks, maintains and manipulates data); communication (how the information is moved around; e.g., from lab to provider); process (the rules of the system that protect privacy and ensure the integrity of the information); and, finally, devices (the one part that you can touch; e.g., the tablet PC, PDA or keyboard and screen).

When he was a fellow at Regenstrief, Zafar conducted research on voice recognition software that would produce text directly from speech—an intriguing concept with obvious implications for electronic medical records. What he and his colleagues found in studying the automatic dictation device, however, is that what works in the world of Star Trek doesn't necessarily work on Earth.

"Voice-recognition technology has reached a plateau in terms of its accuracy," he says. "The problem is that the underlying algorithms that drive those systems, something called hidden Markov modeling, is only good enough to give you about 95 percent accuracy."

In his research, Zafar and his colleagues integrated the best available commercial speech-recognition program into an electronic medical records system and then studied its effectiveness in an emergency department, an outpatient clinic, and on inpatient wards. What they found is that the note size doubled.

"We learned that when people are given the option of providing information via speech, they have a tendency to be verbose, but they don't provide more data," he says.

Even more problematic, he adds, is that critical errors that human proofreaders could not find crept into the notes, such as "continue" instead of "discontinue."

He contends that handwriting recognition technology, by contrast, has realized its promise and offers, in the Tablet PC, an almost ideal interface between person and computer.

"It's as natural as it can be," he says, and is basically the same as pen and paper, but with the tremendous advantage that unlike writing data on paper, where it stays, data written into a computer system is instantly interactive, instantly many places at once, and always where it's needed.

"A lot of electronic medical record vendors are looking at the Tablet PC as the next powerful delivery device for those types of systems because it's mobile," explains Zafar.

The ability to write a note in the patient's room, or just outside, without having to return to a physician work area, improves workflow and gives the physician more time for thought and to spend with the patient, he says.

Another advantage of the Tablet PC is that, unlike paper, it can offer decision support. For instance, when a physician is writing a prescription and inadvertently drops or adds a zero in milligrams, the device can query the order as incongruent with the diagnosis. "That double-check at the point of care really helps improve quality and prevents the errors that can happen," Zafar says.

Although information technologies are powerful and their promise to support improvements in health-care delivery is vast, Zafar emphasizes that the bottom-line has to be *the patient*. "If it doesn't improve patient care and safety, in the end, it's not worth the investment," he says. "We are just now beginning to explore this question. Indeed, some early reports suggest that certain technologies may actually be causing harm because of complex system-design and health-care process issues! The more we embark on integrating technology into our workflows, the more we learn about exactly *what* our health-care

processes are and how they are flawed."

Zafar also emphasizes that, in addition to improving patient outcomes, the technology has work for the physician and not the other way around. In his standard presentation, he cites the case of an "unnamed institution" that spent $20 million on an electronic medical records system and then had to shut it down after three months because people complained so bitterly about having to use it.

He also doesn't see value in a one-size-fits-all approach with a common vocabulary and common ways of practice. "If you do that, you are forcing a very specific and regimented workflow onto physicians who may not be willing to accept it," he says. "Having smaller systems suited for individual providers is probably a better approach, especially in this country where we have so much fragmentation."

Understanding the workflow in medical practices, whether in a primary care office or an emergency department, is a key concern for Zafar. "My research ideas come from my clinical practice. I see what's wrong with clinical practice now, and I'm trying to see how I can fix it. That's the whole premise of informatics: to try to see how technology can improve your practice, and that's where I try to aim my research."

Toward this end, Zafar visits practice sites around the country to observe the fit between technology and workflow. One day he might be at the Cleveland Clinic watching the screens where residents enter orders; another day he might be in rural central Idaho observing workflow patterns in a primary care practice.

Zafar says that one of his roles as a medical informatician is to stand between the physicians and the statisticians and programmers he works with who "sort of understand the workflow process, but sort of don't," and to make the appropriate connection between technology and physician practice so that technology doesn't impede workflow.

Obstacles and Incentives

The federal government—in addition to funding research and supporting implementation efforts through AHRQ—is facilitating the adoption of health-information technology on three fronts: writing interoperability standards for vendors so that different vendors' systems can talk to each other; creating a national data "backbone"—the National Health Information Network—to facilitate information sharing across state boundaries; and, finally, establishing certification standards for vendors, effectively a "Good Housekeeping Seal of Approval" for electronic medical record technologies.

While such efforts will lay the necessary foundation for future adoption of health-information technologies, the everyday realities of health-care delivery in the United States indicate that significant obstacles lie ahead.

When Zafar surveys the current state of health-information technology with its tremendous potential to improve health care, he sees more barriers to adoption than just those related to a medical profession that is traditionally reluctant to embrace new technologies or vendors who don't understand medical practices. Because 90 percent of care is delivered in primary care offices, where physicians have very little money to spend on technology, he sees cost and lack of technical expertise as perhaps the most significant impediments to adoption.

Despite all these obstacles, however, Zafar believes that, in the long term, one very powerful impetus will lead to the gradual adoption of health-information technologies: "We've realized that by not adopting them we're actually causing harm," he says.

When he walks into a patient exam room in his clinic, empowered by all the information his electronic medical record system puts before him, Zafar practices medicine in a way he hopes all physicians in the future will be able to practice—with minimal obstacles between himself and the patient.

"When I'm in talking with patients, taking care of them and their disease, I become an educator; I step away from technology and become a human being," he says. "Basically, I see that the person before me could be my Mom or Dad. Because I know that the system is very complex and there are many different possible paths for them to get where they need to go, I ask myself, 'How do I navigate the system to help them? Which path am I going to recommend they take, and how am I going to help them get there?'

"That's what I think about when I'm with a patient," he adds. "It's very removed from technology."

By dedicating his career to these two perspectives, Atif Zafar knows better than most how information technology can improve health care if it is integrated in a flexible, nuanced, humanistic way.

For now, his goal is simple: to create information systems that will help all physicians deliver care in a way that reflects the full potential of their education, training, experience and compassion. **BP**