Chapter 6
Applied Informatics for Health IT Managers

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Abstract The Health Informatics program at UAB, an early exemplar of an applied health informatics program with a focus on health IT managers, has been able to address the changing needs or the seeming "moving target" of requisite skills needed in the healthcare IT industry. In this chapter, we examine some of the key factors and influences that led to the increasing importance of information technology in healthcare and the concomitant need for individuals with a background in health informatics to oversee the use of those systems. We discuss the development of the health informatics program at UAB, the path our own program has taken over the years and some "lessons learned" along the way.

Informatics education is often misunderstood. Like the discipline itself, which can cover areas as diverse as nursing, physicians, information retrieval, computer programming and others, the educational career paths of graduates of these programs can be varied and there is no "one size fits all" approach to delivering formal academic programs in health informatics. Assumptions about what health informatics graduates can or should be able to "do" once they're graduated also vary widely. As educators and as directors of informatics programs, this makes management of our stakeholders' (i.e. future or prospective employers, hospitals, vendors, etc.) expectations somewhat challenging. This variability has also allowed for a degree of flexibility in areas such as curriculum development, professional development and relationship building with external partners. The health informatics program at UAB, an early exemplar of an applied health informatics program with a focus on health IT managers, has been able to address the changing needs or the seeming "moving target" of requisite skills needed in the healthcare IT industry. In this chapter, we examine some of the key factors and influences that led to the increasing

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importance of information technology in healthcare and the concomitant need for individuals with a background in health informatics to oversee the use of those systems, the development of the health informatics program at UAB, the path our own program has taken over the years and some "lessons learned" along the way.

A Brief History Lesson

A series of legislative actions that occurred over the early to mid-60s helped form the need for informatics as a discipline in the United States. Perhaps the most important of these was the signing of the Title XVIII and XIX amendments to the Social Security Act in 1965 by President Lyndon B. Johnson, which laid new ground for the way healthcare is delivered, reimbursed and accessed [1]. Medicare and Medicaid, established by this act, gave millions of people access to healthcare services they had previously never experienced. This access led to not only increased use of healthcare facilities, it also increased production of health information that would need to be carefully and systematically managed and coordinated. At the time of this law's passing, this management was done primarily by non-clinical staff, and was entirely a paper-driven process.

In the same decade, the "great space race" fueled increased funding for science education and technology spending. While most of this was relegated to the business world, new billing computer systems were implemented in many hospitals, introducing most to their first encounters with automated processing of information. Continuation of the Hill-Burton Act in the 1970s, which gave funding for hospitals to expand their facilities, led to increased hospital construction. Hospitals had to get bigger in order to accommodate the influx of patients who now had assurances of receiving healthcare through Medicare or Medicaid. The capacity for hospitals to submit bills for the services they provided only increased. At the vortex of all three expansions (increased access to healthcare, hospital growth and increase in bill submission), was the proliferation of vast amounts of information about an expanding population of patients. But who would manage all that information? Who had access to it? What could be done with it?

Throughout the 70s and 80s, we saw an expansion of technology beyond the mainframe billing systems and the benefits of computing power was no longer limited to those "behind the scenes" and with very special computer science training. To meet the demands of the increase from federal and state reporting agencies about care provision, some of the clinical disciplines like laboratory, radiology and pharmacy began to see the use of automated systems. Large amounts of information were beginning to be readily available to members of the administrative and clinical communities within hospital settings. But the question remained, who was managing all that information? Who had access to it? What could be done with it? Clearly, the idea that there was a need for individuals with could manage people, vast amounts of information and analyze and design technology was beginning to emerge.

Formation of a Graduate Program in Health Informatics

During the 1980s, the National Library of Medicine began awarding grants to U.S. educational institutions for the purposes of funding graduate education and research in many areas of healthcare and biomedical informatics. The NLM program allowed these institutions to recruit trainees, who would then go on to study and conduct research centered on healthcare, computers and communications technology. The primary focus of these programs was on the medical side of information technology and research. These programs served as precursors to many other healthcare-focused computer science and informatics programs beginning to emerge around the country.

With the advent of many new technologies in healthcare settings and increasing demands to show productivity and efficiencies, many hospitals sought to expand responsibilities for their IT beyond the duties of a data processing manager and hired a Chief Information Officer (CIO). While the CIO's job was more strategic in nature, that is to manage information on a larger scale and to keep up with the proliferation of technology, the healthcare industry did not have individuals with formal training in this area. Data Processing Managers typically had a strong command of the technical environment, but were weaker in the areas of understanding the business of healthcare, the analysis and design of systems and lacked an understanding of the information needs of the clinical communities that they served. The need for this type of individual, and its lack in most healthcare settings, was one of the driving forces in the development of a graduate program that would train individuals to fulfill the skill set required of healthcare CIOs.

In 1989, in the Department of Health Services Administration in the School of Health Professions at UAB, a proposal for a graduate program that prepares senior level managers in the areas of strategy, management and implementation of technology in a healthcare setting was introduced. With the growing introduction of clinical IT systems into healthcare, these goals of the proposed program were aligned with the same goals that were being articulated for the Health Information Management (HIM) profession. The American Health Information Management Association (AHIMA) maintained that the traditional roles that HIM professionals had filled in traditional Medical Records departments were expanding beyond management of the paper medical record, which had long been the central focus of work for many in the HIM profession [2]. The program goals were also aligned with some of the medical informatics training programs, which were beginning to focus on the development of applications that could be used in actual clinical care.

Because of compatibility with the goals for the future of HIM and because UAB had an HIM undergraduate program, the original title of the degree was a Master of Science in Health Information Management (MSHIM). At the time, AHIMA, the professional organization for the HIM profession, was focused on bringing individuals with associate-level training in HIM up to the baccalaureate or four-year degree level. While individuals with an associate degree and the Registered Health Information Technician (RHIT) credential were employed, HIM professionals

would need more academic preparation to assume the leadership roles of the future, and this would be done primarily by moving minimum education standards to the four-year degree level. A masters program was a step ahead of where most HIM programs were focusing.

The curriculum for the proposed program centered on five major components:

1. Foundations
2. Research methodology
3. A thesis project or
4. Administrative internship
5. Electives

According to the original proposal, approved by the University of Alabama Board of Trustees, the objectives of the program were the following:

1. Promote quality of care and cost containment in healthcare facilities.
2. Integrate knowledge of the health services environment and health information with skills in management of health services and health information.
3. Facilitate coordination of clinical, administrative and financial information into interactive databases to better support strategic planning and decision-making in the new healthcare environment.
4. Prepare individuals to assume positions as health information managers or chief information officers.
5. Provide an academic framework to prepare existing healthcare professionals for upward mobility into emerging managerial roles.

Formation of the MS-HIM Program Curriculum

While the focus of the program was to prepare individuals academically for their future careers, it needed to be firmly rooted in the required skill sets of current healthcare CIOs. The director of the program recognized that in addition to the current faculties' efforts, input into the program's curriculum needed to involve individuals currently serving in this capacity. An Advisory Board comprised of individuals from professional organizations, IT leaders in other academic medical centers, professional services consulting firms, and vendor organizations was formed and contributed to the program's curriculum and long-term planning needs.

The original curriculum was based on an empirical role delineation study of hospital CIOs, and the coursework centered around tasks commonly performed by those in this role [3]. In the survey, over 200 CIOs were asked about the tasks most commonly performed and the relative importance of each. The result was a categorization of skills that any healthcare CIO would need in order to be effective. From the study, the emerging idea was that while we had devised an advanced degree in HIM, most HIM professionals were not assuming CIO roles yet. The faculty felt strongly that moving toward a more applied focus in applied informatics, rather than

HIM, would give the degree more value in the healthcare industry. As the 1990s unfolded, AHIMA refocused its professional and academic emphasis on the management of electronic health records (EHR), which created a stronger linkage between applied informatics and health information management. But the relationship with AHIMA and another organization, the American Medical Informatics Association (AMIA), would yield considerable collaborative opportunities to promote informatics education. This relationship is elaborated later in this chapter.

Original Curriculum

The set of courses based on the CIO roles and functions included a set of core foundational courses that all students took as well as research methods and statistics. In addition, students were allowed several electives. The courses in the original curriculum are listed below.

Foundations

- Clinical Documentation and Information Systems in Support of Patient Care
- Healthcare Facility Data Communications
- Healthcare Information Resources Management
- Administrative and Financial Information Systems
- Quality Management in Information Systems
- Negotiating Contracts for Healthcare Information Systems
- Strategic Planning and Benefits Realization for Healthcare Information Systems
- Seminar: Synthesis of Health Information Management
- Information Systems and Management Science in Health Services Administration

  - Systems Analysis
  - Database Management

- Healthcare Delivery and Management Science

  - Introduction to the Healthcare System
  - Organizational Theory and Behavior
  - Financial Management
  - Management Science or Healthcare Elective

Research Methods and Statistics

- Courses in quantitative and qualitative methods and scientific inquiry

Electives

- Courses in topics related to information management, computer science, management, and specific to student goals and specialization

Thesis/Project or Administrative Internship

Because many students have professional and personal obligations that cannot be overlooked, two options for completing the degree were designed. For the non-traditional student who works full time or has other responsibilities, the Non-Thesis Research Project was recommended. The project option does not require a formal thesis, but a minimum of 30 semester hours of appropriate graduate work must be completed in good academic standing prior to beginning. Although thesis research is not required, the student is expected to gain insight into the techniques of informatics-specific problem posing and problem solving; using these insights to prepare a written report and a presentation on their findings to faculty members, fellow students, and their project mentor(s).

For traditional (younger or non-working) students, the Administrative Internship option provides an immersion experience by which they may gain more informatics-specific experience. The administrative internship option provides an opportunity for focused investigation of informatics problems in real-world settings and for application of problem-solving methodologies for development and execution of solutions. Investigation and application of theory is done through a practical implementation project.

> **Lesson Learned**: *By basing the curriculum on the skill set of the role we were training for and by using empirical data to help define that skill set, our students were able to function well in the newly emerging role of managing the enterprise IT systems.*

Changing Landscape of The University of Alabama at Birmingham and an Increase in Health Informatics Master's Degree Offerings

During the early 2000s, The University of Alabama system (including UAB) made a requirement that all of its campuses would begin operating under the semester system, rather than a mix of quarter-term and semesters. While initially the new academic structure required a challenging revision of the entire curriculum to

meet a new timeline, it also provided an opportunity to eliminate some courses that were less central to the current needs of the healthcare IT industry. This change actually allowed the program to be competitive with the number of health informatics master's degrees and concentrations beginning to emerge across universities in the U.S.

The curriculum, while robust and unique in its offering, was extensive and time-consuming. At 63 credit hours, it was nearly the same length as the coursework for many PhD programs. To maintain viability and competitiveness, it needed to continue to be culled, yet still include the required competencies for the emerging healthcare IT management market. Stripping it of many electives and combining course content, where appropriate, allowed the program to remain an attractive offering in the academic marketplace. As discussed later in this chapter, as online education programs became more feasible and as more students expressed interest, this mode of education was revisited and the curriculum was modified into an online format.

Lesson Learned: *The changing educational landscape combined with the needs of students and demands of the field should promote a continual reassessment of coursework and requirements.*

Recruitment and Retention

The MSHIM program was designed to attract individuals with varying backgrounds of professional and academic training. Because of the strategic needs of the CIO, those with management experience were preferred, since they could more easily move into a senior leadership position upon graduation. The first students entered the program in spring of 1991 and had work experience that varied from 5 to 15 years across a variety of positions. Students were primarily located in Birmingham, and many of them lived very close to the UAB campus because of their employment by the University of Alabama hospital, the academic teaching hospital for the University of Alabama School of Medicine, which offered tuition benefits.

Some students were full-time students completing their degree in a little over 2 years. Others, however, worked full time and took classes part time. The added flexibility of being able to enroll in any of the three terms per year was a bonus for working professionals who wanted to expand their career options. Likewise the administration of the program realized that, unlike full-time students, part-time graduate students who were working professionals have shifting priorities in their personal and professional lives that often put school on the back burner. The program allowed students to "drop out" of courses during or before one term and pick the courses back up the next time the course was offered. It was not uncommon to see

students take classes for only two of the three traditional terms (fall, winter/spring, summer) because the course offerings were not always aligned with students' schedules.

Changing Student Body and Healthcare Environment

Over time, the student body became more diverse in both profession and degree of experience. Some of the students continued to be those with a great deal of experience in the field of health information technology, while others were clinicians with limited technical knowledge, who were interested in getting into the Health IT field. Still others came with a strong technical or business background, but with very limited knowledge of healthcare. Finally, many applicants were foreign students with technical and clinical expertise, but no knowledge of the U.S. healthcare system. While this diversity was in many ways stimulating, it was also very challenging to bring the students to a basic level of expertise in healthcare and technology. Clinicians needed to become more comfortable with the technology, non-clinicians needed to know more about healthcare, and both groups often needed to become more knowledgeable in management and health informatics theory and concepts.

By the late 1990s, Internet usage had become routine. Home users were connecting with faster modems, or buying services from their phone or cable companies for high speed Internet access. Businesses that were using e-mail for internal and external communication began taking advantage of the growing network of home users. Newspapers and magazines offered content on the World Wide Web, libraries placed their catalogs and vast archives on the Internet (FTP or Telnet really), corporations set up informational and advertising websites.

Healthcare was no exception. Hospital administration and finance departments needed to connect with the Internet to carry out normal business. Large data sets which used to be transmitted on magnetic tape were able to be sent instantaneously via FTP. Large financial transactions were conducted electronically.

But the infusion of the Internet was not limited to the back-office operations of healthcare. WebMD, which launched in 1996, provided medical information to the average Internet user. Connected patients could look up their symptoms, research their diagnoses, and access information which was previously unavailable to them. Clinicians also benefitted from the Internet. Large reference volumes first became available electronically, such as the Physician's Desk Reference, and later were available via the Web.

Technology was changing rapidly to keep up with the growing demands of the Internet. Physical networks were carrying more bandwidth. Phone companies were investing in fiber optic cabling to support the aspirational gigabit Ethernet. Wireless networks were growing in popularity as the protocols supported more bandwidth and encryption became stronger. No longer could the healthcare IT executive delegate the responsibility for infrastructure to the IT Operations Manager.

A decision was made to revamp the Networking and Communications course to provide more of a foundational knowledge of the concepts. The course contained a lab component in which students had the opportunity to install and configure their own networks, experiment with public key infrastructure and certificates. To further expand the scope of technology in the program, the software design and analysis courses were modified to focus more on computer programming.

While the NLM training programs (see Chap. 3) focused on developing informatics applications and hence, incorporated significant computer programming experience, the UAB program was aimed at preparing system managers and had not previously had as strong to much of a computer science and engineering focus. The change, coupled with the varied student backgrounds, was challenging for both the students and the faculty. In the networking course, the students gained a very thorough understanding of the technical details of the infrastructure. However, while this was helpful to the students who had some background in IT, or for those students who were just more technologically inclined, those students with a healthcare background, who understood the importance of using technology, failed to see how understanding the distinction between hub, routers and switches was relevant to their needs.

Because so many of the students had no prior experience with programming, the majority of time was used to help students understand the different types of variables, when and how to use functions, and the advantages and disadvantages of stored procedures. Students at all ends of the spectrum found this approach to be unsatisfying. Those with more technological background found it too basic and those without the background could not see the relevance to the big picture of managing the technology.

The IT manager today is expected to be the bridge between the clinicians, the administrators and the technical staff. The negative student reaction prompted a reevaluation of the level of proficiency required for key the target role. To train the executive, the curriculum needed to address a variety of programming languages to highlight the different uses for each. More time was needed to emphasize the importance of the design process, how to gather requirements, elicit feedback, and do proper quality assurance. Today, the curriculum is more technical than it was when the program first started, but is less focused on the technology per se and more on how it is used than it was in the interim period.

Lesson Learned: *Comfort with, and knowledge of, technology is essential for anyone choosing health informatics or health IT as a career. Because teachers in health informatics tend to be technically proficient themselves, there is a risk that they will misjudge the needs of students who are not going to be application developers or informatics researchers. The degree of proficiency and the depth of knowledge of various subjects must be geared to the requirements of the role to which the educational program is aimed.*

Changing Learning Environment

It became clear that much of the flexibility offered by the program came at a cost. Students often lacked continuity with one another during their matriculation, which is an important element in the long term success/satisfaction with graduate programs. Students often commented about the lack of unity among their fellow students, who they would see in class for a few semesters, but then might not see again for another year. If the program desired graduate students who would be invested in their education beyond graduation, it needed to provide a more cohesive delivery format and give the students more of a sense of community and belonging. Likewise while the curriculum was very attractive to working professionals, the market of qualified individuals in the Birmingham area was eventually saturated, and the target audience beyond Birmingham was being paid too well in their current jobs and was not interested in moving somewhere else to complete a degree.

To align students' expectations and reduce the administrative time spent managing matriculation plans of individual students, the decision was made to decrease some of the curricular flexibility and move to a cohort model, admitting students as a "class" only in the fall semester. While the initial change meant a drop in admission of students, there has been an increase in camaraderie, networking and sense of identity among the students. In order to capture the growing market of students who were interested in health informatics degrees, the decision was made to offer courses in a blended-delivery format of two brief on-campus visits per year with most of the course work delivered in an online format. Even when the overall content was similar to the previous courses, the decision to move to an asynchronous distance learning format required a redesign of the specific content and especially the pedagogical methods as well (see Chap. 2 for more discussion of online education).

UAB was an early adopter of online informatics education, but the decision was guided by the same environmental assessment that had guided previous curricular changes. Today, in the U.S. and elsewhere there is an increasing number of online informatics education offerings, as shown in many of the other chapters in this book.

Health Informatics Managers of the Future

Role of Professional Associations

Throughout the course of our program's existence, various members of the faculty have held leadership positions in national, state and local chapters of the Health Information and Management Systems Society (HIMSS), the American Medical Informatics Association (AMIA) and the American Health Information Management Association (AHIMA). Membership and visibility within each of these professional organizations has merit and these organizations' goals of promoting better

healthcare through the effective use of healthcare information and technology align with the program's goals. However, since each organization has somewhat differing interests, it can be challenging for a program such as UAB's, with students from varying backgrounds, to determine which organization best matches its current, and more importantly, future directions. Similarly, it can be challenging for students to select programs that are most closely aligned with their background and interests. In an attempt to sort out the differences among the organizations, AMIA and AHIMA have stated that "AMIA is the professional home for informatics professionals who are concerned with basic research in the field or any of the biomedical or health application domains, either as researchers or practitioners. AHIMA is the professional home for health information management professionals, with a focus on those elements of informatics that fall under the health informatics area of applied research and practice" [4]. Still, this distinction is not entirely clear to outsiders. Each of the organizations also has recommended competencies for students and requirements for informatics educational programs that are similar but not identical. AHIMA has a long history of certification examinations for individuals [5] and most HIM programs are accredited by The Commission for Accreditation of Health Informatics and Information Management Education (CAHIIM) [6]. HIMSS has developed a number of individual certification programs including the Certified Professional in Health Information & Management Systems (CPHIMS) and a new certification program for entry level professionals, Certified Associate in Health Information & Management Systems (CAHIMS) [7].

In late spring of 2007, AMIA gained funding from the Robert Wood Johnson Foundation to define the content and training requirements for a medical subspecialty in clinical informatics. Ultimately, the American Boards of Preventive Medicine and Pathology became the sponsors of the new subspecialty examination, with the first certification exam in the fall of 2013 (see Chap. 4 for additional details). While the medical subspecialty has not had a significant impact on our curriculum or our target audience, it has heightened the awareness of the formal role of informatics in the clinical community. Likewise, the curriculum requirements for this subspecialty align very nicely with our program's existing curriculum. Clinical informatics, which had once been a profession often described as "doctors who like computers" now had a legitimate home and a recognized credential, which serves to standardize the training that clinical informaticians receive and ultimately, may expand training opportunities [8]. In addition, an AMIA task force has published a definition of competencies in biomedical informatics that go beyond those for the physician subspecialty in clinical informatics [9]. Maintaining visibility in all three professional organizations is crucial to our program's success. Our faculty's long-term commitment to each organization has resulted in invitations to participate in their long-range academic strategic planning efforts, where we've been able to provide perspective and recommendations that will affect future informatics and health information management graduates and faculty.

The curriculum will be guided by all three of these professional organizations, to some extent, for the foreseeable future. From a marketing perspective, it will be important to outline, for future students and faculty, the parallels between the

organizations and how we work with them. Examples may include a crosswalk between the three professional organizations' academic preparation goals (i.e. content areas) and the resulting target career paths of each group.

Lessons Learned:
1. *The professional informatics associations are a useful source of information for educational programs for guidance in defining the competencies their graduates need.*
2. *Informatics educators should stay involved with the informatics professional organizations to learn from fellow educators and to shape the organizations' directions.*
3. *Unless one organization is completely aligned with program goals, it may be advantageous to maintain affiliations with multiple professional organizations.*

Managing the Challenges of the Future: Politics, Shifts in Informatics Foci, and Emerging Technologies

The Political Landscape

The health IT political environment over the last 20 years has been in a constant state of flux and it was often a challenge to keep the curriculum current. For instance, although the Health Insurance Portability and Accountability Act (HIPAA) [10] was enacted in 1996, the initial standards for privacy and security of protected health information were not finalized until 2003. During this time, there was a great deal of confusion about the exact requirements of the law and when the standard would take effect as there were numerous extensions and waivers and exemptions. Since privacy and security were a key part of the curriculum, these changes needed to be incorporated.

The HIPAA law and the privacy and security regulations took a prominent place in the curriculum (and in every doctor's office). This was a new and evolving topic and the instructors were constantly adapting and updating their materials. In many cases, they were reviewing the new rules alongside their students – many of whom were working and implementing the policies in local healthcare organizations.

Another major impact was the passing of the HITECH Act, part of the American Recovery and Reinvestment Act (ARRA) in 2009 [11], which brought a major up shift in adoption of health IT. Our existing program's curriculum has prepared many successful individuals throughout its history, but with this passage, we now face near constant change in the knowledge base and required skill sets for healthcare IT professionals. These changes will certainly have an impact on our future

curriculum and the ways in which it will need to be offered. For example, since the program's inception, we have focused on training individuals to assume leadership positions primarily in managing healthcare information technology primarily in hospitals. While this continues to absorb many healthcare IT resources, the adoption of healthcare IT in the outpatient environment has grown significantly. With this shift comes the need to concentrate more critically on the goals, management, workflow and motivations of individuals working in outpatient physician practices – both small and large, primary care and specialty clinics. The type of technology that is implemented in practices can be quite different and there are now many delivery models (cloud-based vs. in-house, independent vs. hospital owned) and adoption strategies that must be considered. One of the main strengths of the graduates has been their ability to convince healthcare organizations' leadership of the advantages of moving toward an electronic health record. The passage of ARRA made this particular purpose somewhat obsolete, since now it does not take much convincing. In a sense we reached and crossed the finish line but a sizable portion of the curriculum was still centered on strategies to convince people they needed to make the leap to an EHR; and the ensuing system selection and implementation strategies. It is important to shift our focus to look at the skill sets of leadership in a world where the use of health IT is accepted as part of the cost of doing business.

As has been stated elsewhere, graduates' primary role was to both influence, and support the clinical, administrative and technical communities of practice and we have achieved success in these areas. But we also recognize that we are training a workforce that has always had technology at their fingertips and expects it to be a constant support to them. In other words, these "digital natives" do not need to be convinced of the merits of using technology; they sometimes do not know how to manage without it. This shift is also becoming evident in patient communities becoming much more knowledgeable about technology. With technology to manage nearly every aspect of their lives, patients now expect healthcare to keep up at the same pace and support them in their health management goals. The rise of the patient as a consumer will require a shift in the focus of our curriculum from its original target audience (i.e. those working or practicing in healthcare organizations, where their primary clientele were administrators and clinicians) to individuals who have a greater understanding of the information technology needs of patients. Understanding the motivations and needs of the patient community will require knowledge of new strategies to elicit information and new ways of forming relationships beyond those required for interaction with clinicians and administrators.

The passage of the ARRA HITECH Act actually allowed us to look beyond EHR implementations and restructure our curriculum in ways that will be beneficial for students for many years to come by focusing on optimizing existing systems to enable better patient care, increase engagement and satisfaction, provide a more satisfying user experience and help organizations think of data from the EHR not just as canned reports, but as an organizational asset, that, with proper analysis, can

be used for healthcare quality improvement and increased efficiency. However, the increased focus on the patient and the need for academia/practitioner collaboration is not the only change on the horizon. Increasingly the use of social media is a part of patients' lives and will need to be incorporated into healthcare IT as well. Managing healthcare IT in the future will require integrating genomic data with clinical data as personalized medicine approaches begin to be incorporated in healthcare. All of these rapid advances in technology and changing roles of health IT leaders will require individuals who can balance the risks and rewards of innovation as the scope for health IT leadership and management expands.

Successful planning for, and management of, the constant changes in healthcare IT require the full-time attention of interdisciplinary teams. This can be modeled in the educational setting by involving adjunct faculty from the practitioner community with the design and implementation of our courses and opens up more opportunities for collaboration between academia and practice.

Summary

The educational path that has been forged for future informatics managers has been an interesting and rewarding one. Informaticians, once a voice in the wilderness for promotion of information and communication technologies to improve healthcare outcomes, have begun to see support from professional associations, academia, and more recently, even from public citizens. The joining of these voices has mostly been harmonious, and the traction that has been gained has led to an increasingly higher focus on the necessity of formal informatics education and training. But the present rate of change in both our technical and political realms will ultimately determine our future. Issues such as the fate of Obamacare and other pending legislation, the ability to bridge the "digital divide" (i.e. those who should, but do not have access to technology that could help them) and the ability to keep up with the unprecedented era of "big data" need to be very carefully considered and integrated into the curriculum. This is not to say that our curricula and programs should or will be a driven by the most recent trends, it merely means that we are dealing with a rate of change and support that has never been seen before. The ability to impart and balance the enduring curricular components that are the foundation of many of programs with the rapid rate of change in the healthcare IT industry will present many new challenges to program directors. Likewise, we are beginning to see interest in informatics education from the "digital natives", or a student population that does not know or understand a world without technology to support it. Teaching this new population of students will require a shift from our traditional means of delivering education to thinking about student learning in ways that we have not done before. There is no shortage of management challenges facing us, and our future as program directors, faculty, advisors and mentors seems tenable for the foreseeable future.

> **Key Take-Away Points**
> - A program for education of operational healthcare IT managers should be based on data on what these managers currently do and need to do in the future.
> - As healthcare and the role of health IT within it changes, there should be ongoing curriculum review and modification to address the emerging needs.
> - Because the academic faculty may not be practitioners, the degree of proficiency and the depth of knowledge of various subjects must be geared to the requirements of the role to which the educational program is aimed, not necessarily to how the faculty themselves were trained.
> - Health IT practitioner input to academic programs is valuable when students are being trained for operational health IT roles.
> - It is mutually beneficial for health informatics educators to maintain involvement with health informatics professional associations. The associations can provide guidance on curriculum content and networking opportunities for both faculty and students. Health informatics educators' can provide input into professional informatics associations' educational activities.

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