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Implementing Pharmacy Informatics in College Curricula: The AACP Technology in Pharmacy Education and Learning Special Interest Group

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Abstract
Many professional organizations have initiatives to increase the awareness and use of informatics in the practice of pharmacy. Within education we must respond to these initiatives and make technology integral to all aspects of the curriculum, inculcating in students the importance of technology in practice. This document proposes 5 central domains for organizing planning related to informatics and technology within pharmacy education. The document is intended to encourage discussion of informatics within pharmacy education and the implications of informatics in future pharmacy practice, and to guide colleges of pharmacy in identifying and analyzing informatics topics to be taught and methods of instruction to be used within the doctor of pharmacy curriculum.

Keywords
curriculum, pharmacy, AACP, pharmacy informatics

Disciplines
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SPECIAL ARTICLES

Implementing Pharmacy Informatics in College Curricula: The AACP Technology in Pharmacy Education and Learning Special Interest Group

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Many professional organizations have initiatives to increase the awareness and use of informatics in the practice of pharmacy. Within education we must respond to these initiatives and make technology integral to all aspects of the curriculum, inculcating in students the importance of technology in practice. This document proposes 5 central domains for organizing planning related to informatics and technology within pharmacy education. The document is intended to encourage discussion of informatics within pharmacy education and the implications of informatics in future pharmacy practice, and to guide colleges of pharmacy in identifying and analyzing informatics topics to be taught and methods of instruction to be used within the doctor of pharmacy curriculum.

INTRODUCTION

Many professional organizations have initiatives to increase the awareness and use of informatics in the practice of pharmacy or the use of pharmaceuticals in practice. Some initiatives include the American Society of Health-System Pharmacist's statement on the Pharmacist's Role in Informatics[1] and the Institute of Medicines' Preventing Medication Errors: Quality Chasm Series[2] as well the American Medical Informatics Association "A Roadmap for National Action on Clinical Decision Support"[3]. Within pharmacy education, we must respond to the changing use of technology within the profession. Given the importance of technology in pharmacy practice, we must make it an integral part of all aspects of the pharmacy curriculum. Within pharmacy education, informatics can be defined as the science that uses digital information to improve pharmaceutical outcomes and student learning.

The need for this document arose out of discussions at the 2006 business meeting of the American Association of Colleges of Pharmacy Technology in Pharmacy Education and Learning Special Interest Group (TiPEL SIG). TiPEL SIG was formerly known as the Electronic-Based Instructional Resource Special Interest Group (EBIR SIG). These special interest group members are interested both in the teaching of informatics as well as the use of informatics as an aid to student learning. Membership in TiPEL includes leaders in the fields of pharmacy informatics from colleges across the country. Volunteers were requested to assist in the document's development both at the business meeting and via the TiPEL Listserv. Development occurred through committee participation, conference calls, Listserve communications, and direct e-mail. Drafts developed by these volunteers were posted during the documents development for TiPEL SIG membership comment. After development, the document was approved via electronic vote as representing the SIG's thoughts.

This paper is intended to encourage discussion and provide support for colleges of pharmacy to systematically

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examine questions related to the development of an informatics component within the PharmD curriculum. Five central domains for organizing planning related to informatics and technology within pharmacy education are proposed. Domain 1 is intended to guide colleges and curriculum planners in developing focused topical content in informatics and related automated systems/technology within the PharmD curriculum. Domain 2 guides colleges toward an iterative approach to evaluating the use of technology as a tool for student learning. Domain 3 stresses the necessity for college administrators to actively recognize individual faculty members' efforts to use technology as an adjunct to instruction, provide support in development of technology skills among faculty members unfamiliar with available tools, and reward faculty members who use technology to develop innovative instructional "tools". Domain 4 emphasizes the necessity for pharmacy developing a leadership role within healthcare pharmacy informatics to improve healthcare outcomes, and to emphasize the pharmacist's role as the medication-use expert. Finally, Domain 5 outlines critical elements related to development of graduate programs and pathways for informatics in pharmacy.

DOMAIN ONE: STUDENT EXIT COMPETENCIES IN INFORMATICS

The Accreditation Council for Pharmacy Education (ACPE) currently identifies expertise in informatics as one of the required competencies for pharmacy graduates.[4] Expertise is defined as both adequate knowledge of informatics and the application of existing and emerging technologies into practice. As endorsed by the Joint Commission of Pharmacy Practitioners "Future Vision of Pharmacy Practice,"[5] the preferred vision for professional practice includes pharmacists having primary responsibility in the oversight of medication distribution and selection/optimization, activities that rely heavily on computing, data and information management, and communication technologies.

Before colleges of pharmacy can make definitive progress in this regard, it will be necessary for the AACP to offer more extensive guidance related to future standards than are currently available. The present requirement is to define foundational informatics training issues in the pharmacy curriculum. Colleges need guidance with delineation of prepharmacy technology entrance-level skills. More importantly, they require insight into outcome informatics performance that will be expected of their graduates. Topics will be diverse, including terminology, distribution, and a working understanding of knowledge systems. Other logical topics range from basic computer science knowledge (data management, warehousing, electronic communications between people or systems, and architecture of systems) to applications, including automation, smart systems, decision support, computers in patient safety, medical coding, information reliability, retrieval, and literacy. A myriad of other topics will emerge as these are considered.

Pharmacy practice educators should collaborate to develop accepted discipline-wide standards and guidelines on educational outcomes. Either focused meetings or online discussions of these topics could best guide colleges in developing outcome performance expectations in these interrelated computer topics. Perhaps a consortium of pharmacy and information technology organizations could provide a forum for establishing a consensus summary on best practices. The development of foundational training within colleges of pharmacy is outside the intent and scope of this paper, but is also considered crucial.

Each college and program must chart its own course for incorporating informatics into existing pharmacy curricula. It will be important for each college to periodically define its own student performance, exit competencies, and best practices with corresponding curricular mapping in the informatics/technology realm. Ideally, this phase would occur after foundational issues described above are resolved. In defining program standards, colleges should consider a number of factors.

The authors recommend that program plans begin by focusing on terminology and the roles of technology and automation to various areas of study, including healthcare informatics standards and principles, and communication and collaboration skills for participating in an interdisciplinary healthcare informatics team. Curricular consideration should be given to basic evaluative skill sets and needs analysis in (1) the accuracy and authority of professional, scientific, and lay online information, (2) electronic documentation skills from the first week of the curriculum to the last day of the advanced pharmacy practice experience, (3) the use of the electronic medical record as well as recognizing the significance of the availability to specific patient information from any practice setting, (4) review of current healthcare informatics in the marketplace and, (5) informing students of data security and confidentiality issues including those established by federal law (eg, Health Insurance Portability and Accountability Act regulations).

Educators should also design curricula to teach students clinical decision support systems so that students have knowledge and skills in evaluating available software, know how to effectively and efficiently use that software/appliance within a patient-centered systems practice approach, and are capable of adapting their

knowledge and practices to smart systems and future applications and innovations. In terms of public health or population health, effective programs should teach skills for the evaluation of outcomes, medication safety, and rudimentary data mining. Basic automation systems that support the medication use process must also be addressed. While an array of issues would be possible under the broader topic, fundamental subtopics are likely to include:

- Infrastructure (ie, mobile computing, telemedicine, remote systems, robotic devices)
- Business operations and rules (ie, medication purchasing and financial processes, regulatory requirements)
- Medication order entry process (ie, computerized provider order entry [CPOE]),
- ePrescribing
- Medication dispensing and distribution (ie, robotics)
- Medication administration (ie, intravenous smart pumps, bar code administration, radio frequency identification)
- Information storage, retrieval, evaluation, and dissemination

Finally, pharmaceutical education programs should speak to student competence in patient education and consultation as well as the ability to maintain professional competence in the face of emerging information technologies available to either the profession or the public.

DOMAIN TWO: INFORMATICS AS AN AID TO STUDENT LEARNING

The goal for the use of technology in instruction, as well as instruction about technology, is to inculcate in students an appreciation for the critical importance of technology. Educators must be aware of educational development software or developed computer-aided learning (CAL) software and select the best tool, whether that is chalk on a blackboard or CAL to improve student learning. Informatics may be considered by faculty members as an adjunct or in some instances the primary educational delivery modality to achieve this goal.

The immediate availability and accessibility to students of electronic-based instructional delivery tools is often desirable in meeting the needs of students, considering the diversity of individual learning styles. However, the introduction of informatics-based technology is not simply to post text on the Web to address issues of access. It must include the integration of informatics and technology into the curriculum through which students learn, including such methods as computer-assisted instruction in interactive learning, multimedia, multi-user, and discussion board formats. Collaboration among colleges to gather the necessary resources may prove to be vital in achieving this goal.

It is critically important that colleges and schools of pharmacy ensure that an appropriate infrastructure exists to support the use of technology for curricular delivery and that this infrastructure reflects the needs and skills of the faculty members. Critical masses of faculty members interested in technology and informatics are typically necessary to foster a local environment for progress at any particular school or college. This is an important consideration for administrators as they engage in expanding or in building a faculty. Developing technology infrastructure and expertise, and establishing methods for building and maintaining competency among teaching faculty members should include planning for adequate equipment and facilities, software applications, and training and development opportunities for faculty and support staff members. This presumes that an adequate resource base will be allocated not only to the start-up of such an initiative but will be committed to the ongoing process of technological enhancement. Further, faculties must be ready to adapt to new and emerging instructional technologies and not hold on to older instructional technologies that have been supplanted.

Educational training technologies that are likely to be effective are tutorials and interactive simulation laboratories and technologies used to support collaborative projects and multimedia applications. Interactive simulation laboratories are considered a particularly effective method of instruction and includes the potential for the development of teaching tools such as cyber-patients, cyber-rounds, and cyber-cases for consistent, stimulating, and accessible student learning and assessment. Simulated environments and interactive laboratories can also be used by other clinical students and faculty members, both on their own and in support of multidisciplinary educational collaborations.

Educational delivery technologies that would lend themselves well to the integration of informatics into pharmacy education include various forms of distance education, asynchronous learning tools (eg, discussion threads), self-paced learning modules (Web-based or computer-assisted), and discussion groups. Further important consideration should be given to test administration, course and teaching evaluations, and security.

When planning infrastructure needs, planners should not overlook the potential for such technologies in providing high quality and accessible continuing professional learning for practicing pharmacists. Indeed, for

geographically dispersed practitioners, distance learning and technology-based options for professional development are virtual imperatives.

Because developing the necessary technological infrastructure described above has significant expense attached, collaboration among colleges to gather the necessary resources may prove to be vital in achieving this goal. Similarly, finding new and innovative means of collaboration with the private sector may also play a key role in any successful program transition.

DOMAIN THREE: SUPPORT FOR INDIVIDUAL FACULTY EFFORTS IN PROMOTING INFORMATICS

Successful implementation of informatics and technology within pharmacy education necessitates that pharmacy educators and administrators work in concert. This relationship will be challenged, since several potential barriers to successful implementation exist. The primary hurdles are likely to appear in the areas of skills, costs, and recognition.

Skills in informatics will be a barrier as many pharmacy educators may not be familiar with informatics tools now available, or understand how these tools may be incorporated into their courses. Administrators are encouraged to develop a culture that empowers pharmacy educators in the area of informatics. Colleges of pharmacy should begin to include informatics and educational technology as areas for routine faculty development. Encouraging educators to incorporate informatics tools and skills in the educational environment integrated throughout the curriculum should be the goal of these activities.

Costs are a barrier as access and use of technology generally entails significant financial outlay. Educational costs are a constant concern for administration, but sufficient financial resources must be made available for informatics to be successfully implemented within college curricula. Administrators are urged to be creative and perhaps collaborative as they seek to meet the needs of their pharmacy educators and students.

Lastly, without recognition, pharmacy educators may not feel obliged to become engaged in attempting to marry informatics to the educational environment. Integration of informatics into pharmacy curricula will necessitate a considerable time investment. Administrators are encouraged to find ways to facilitate the expansion of informatics within pharmacy curricula and to provide recognition to those educators who commit significant time and effort to this task. Simply stated, creative use of informatics in student training must be recognized by promotion and tenure committees.

This panel offers a number of recommendations to college administrations. First, is the need to ensure that the scholarship of teaching is part of promotion and tenure guidelines. Administrators and promotion and tenure committees must recognize the academically valid and creative efforts by faculty members to propagate and encourage adoption of new technologies. Administrators must remember that they will get what they reward.

College administrators must also develop methods for documenting informatics creativity and pedagogy. In some cases, simply modifying existing instruments and processes may suffice; however, in other cases, different methods may be better suited to technologies employed.

Those planning informatics programs should make investments in technology an institutional priority. Administrators must create infrastructure consisting of the necessary hardware and software to promote informatics as an instructional tool and to ensure that competency in this domain is a student performance outcome. Additionally, appropriate technical support infrastructure should be present in all research, teaching, and practice environments.

A culture of informatics and educational creativity/innovation should be fostered. Administrators must create an environment that promotes and encourages faculty members to use and teach informatics to address student learning. In order to achieve a proven and thoughtful program, administrators should expect to devote time and resources to problem solving, and be willing to allow experimentation (accept some level of risk/failure) on the part of those charged with its development.

Faculty development initiatives in informatics should be undertaken as part of this overall culture. Colleges must move maintenance of information and technology competence of pharmacy educators from an individual interest to an institutional requirement. Administrators must increase the technology competence baseline of the teaching workforce.

The panel also recommends that administrators explore distance instruction as a portal to meeting the educational needs of tomorrow's students. Faculty members must understand the value of the portability and accessibility of distance instruction (eg, Web-based instruction) to support their training efforts. The professoriate must accept that its most important goal is for students to learn and that may require faculty members to move out of their comfort zones as they incorporate new technologies. Educators must determine and apply the appropriate tool for student learning, whether that is chalk or technology.

DOMAIN FOUR: ACADEMIC LEADERSHIP WITHIN HEALTHCARE PHARMACY INFORMATICS

With the maturation of healthcare informatics, it is time to recognize the current and future leadership roles for pharmacy. Outside of the informatics realm, pharmacists are considered the drug use and monitoring experts. Within the pharmacy informatics area, we are not the experts in software design and often are not involved in software design in any substantive way. Further, due to the nature of ubiquitous user-friendly drug information software, pharmacy as a discipline risks losing the traditional drug expert resource role.

Pharmacists are the most effective resource in selecting hardware and software to support the medication use process in institutional, community, and public venues. This includes within existing healthcare distribution models and future ones. Pharmacy educators for years have stressed the importance that pharmacists become less associated with the prescription product and instead be recognized as dispensers of information to the public and to all healthcare colleagues. Without strong informatics training and accessibility to portable drug information in daily practice, pharmacy professionals run the risk of being out positioned within the medical community in their quest to assume an expanded role as experts in drug use and monitoring. To miss this opportunity would have serious ramifications to both education and practice.

Pharmacists must be leaders in the use of robotic and distributive systems throughout the healthcare enterprise. Further, pharmacists must be involved in software design and development. Potential future paradigm shifts secondary to technology put even the traditional distributive roles of pharmacists at risk. Further, pharmacists must be involved in the design, development, implementation, management, and training of the clinical decision support systems being developed for complex medication orders. Commercial or internal knowledge bases have many challenges and these are best identified by pharmacists, who have traditionally been problem solvers in the delivery of medications to individual patients. This role must be expanded upon and pharmacists must be recognized as the experts in the medication use system for populations of patients. Pharmacists are uniquely qualified to interpret the information that is now nearly ubiquitous. With the portability of information, other health disciplines, or even patients may reevaluate the need for pharmacists, incorrectly concluding that the pharmacist's role can be safely reduced. Therefore, maintaining the role of pharmacist as the authoritative voice among new, often inexperienced (untried) and frequently conflicting sources of drug information is critical to the profession and to patient safety. In order to maintain a viable, leading role in the healthcare process, tomorrow's pharmacist will have to be more knowledgeable, skillful, and responsive than ever before. Education in pharmaceutical informatics and the use of informatics technology in pharmacy practice could be critical in securing that role.

Moreover, the role of pharmacist — as either product-based or information provider— must be judged in terms of value to the consumer, the patient. Pharmacists are still the most accessible health professionals throughout the healthcare continuum and must develop that strength to maintain control over future distributive and smart systems.

Along with this, the vital person-to-person role in care that pharmacists have traditionally provided for all patients must be strengthened. With other health care providers triaging patients through a myriad of answering systems, office assistants, insurance agents, screeners and the like, the value of pharmacists who provide accurate and understandable information and guidance through personal interaction has the potential to become more highly prized than ever before. To maintain this role, members of the profession must demonstrate to the public their ability to interpret drug information from a wide range of sources.

DOMAIN FIVE: GRADUATE PROGRAMS IN PHARMACY INFORMATICS

Given the necessity for pharmacy academic leadership in healthcare informatics training, it is reasonable to expect that graduate programs in various aspects of informatics would follow the traditional model for research, training, development, and implementation of pharmacy informatics by the profession and disciplines within pharmacy. Administrators must recognize the need for faculty development in various areas of health informatics, including data management, automation in dispensing, information acquisition and communication, and educational technologies. Furthermore, colleges should provide regular training opportunities to their members to build new skills and enhance their abilities in using informatics in academic and clinical practice.

Program administrators/planners should strongly consider developing residency programs and graduate and doctoral degree programs in informatics whenever possible. Graduate programs could provide in-house training and support of all pharmacy academicians and curricula. In the absence of graduate programs, collaborative efforts should be undertaken to provide education and training opportunities in informatics for faculty members. Having support from faculty informatics specialists

would ensure that faculty members would be more adept at the technology and current hardware than entering students, leading to stronger educational outcomes. Entering students often have more technology skills than faculty members, but lack the problem-solving and application skills to optimize that technology. Graduate programs would provide some level of assurance that faculty skills would be sustained at a high level over time.

Scholarship and research in informatics by college faculty members, residents, and students must be promoted and encouraged, and even worked into existing incentive and reward systems. Graduate programs provide an excellent underpinning for implementing educational requirements and opportunities for residents and students to engage in informatics-based research.

Within the research realm in patient delivery, partnerships with industry/engineering programs offer opportunities for innovation and for collaboration across disciplines that must be explored. New, evolving, and yet-to-be-recognized sciences (bioinformatics, genomics, proteomics, and metabomics) integrate informatics within their core curriculum. Colleges of pharmacy should either collaboratively or individually (as resources permit) engage their counterparts in these disciplines, seeking to secure a significant role in the healthcare process of the future rather than abdicating that role to other health researchers.

The fact that there are now multiple federal initiatives underway that include allocation of resources outside of the pharmacy realm should be of some concern since this pattern represents paradigm shifting potential. The need for research in multiple venues currently exists and graduate programs are required to hold that research within the realm of pharmacy.

Moreover, the role of software and information science in the research and analysis of both patient-specific (or population-specific), evidence-based data that guides public decision making for allocation of public resources should be considered. As colleges of pharmacy become more active in public health issues, informatics capabilities would dramatically increase their capability to inform public decision-makers and play a constructive role in public health policy.

CONCLUSION

With technological changes occurring on a daily basis, colleges must examine possibilities for incorporating emerging informational, delivery, and teaching technologies into existing programs in order to solidify the role of the pharmacist as a highly valued member of the healthcare team of the future. The TiPEL SIG recommendations presented here provide support and guidance to colleges for implementing informatics in pharmacy curricula.

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