Rationale for Informatics in Pharmacy Curricula

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Illinois Council of Health-System Pharmacists
September 12, 2014

The speaker has no conflict of interest to declare.

Medical Informatics – Health Informatics (health information systems, health care informatics, healthcare informatics, nursing informatics, clinical informatics, or biomedical informatics) *

- Discipline at the intersection of information science, computer science, and health care. **It deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.**
- Health informatics tools include computers, clinical guidelines, formal medical terminologies, and information and communication systems. It is applied to the areas of nursing, clinical care, dentistry, pharmacy, public health, occupational therapy, physical therapy and (bio)medical research.

* Wikipedia

Learning Objectives:

1. Distinguish pharmacy informatics from health informatics.
2. Discuss approaches academic pharmacy programs can take to address the educational needs of new graduates with respect to pharmacy informatics.

Medical Informatics

- The study, invention and implementation of structures and algorithms to improve communication, understanding and management of medical information. -Homer Warner, Univ. of Utah

Bioinformatics*

- Interdisciplinary field that develops and improves upon methods for storing, retrieving, organizing and analyzing biological data. **A major activity in bioinformatics is to develop software tools to generate useful biological knowledge.**

* Wikipedia

"We must invest not only in technology, but also in the education, training, and healthcare professionals who have knowledge and skills beyond clinical training. Every hospital, clinic, and healthcare organization will need professionals versed in informatics to assist with implementation, use, and success of health IT systems."

Don E. Detmer, MD, MA, Past AMIA President

Pharmacy Informatics

- Scientific field that utilizes a systems approach to medication-related data and information – **including its acquisition, storage, analysis, and dissemination** – in the delivery of optimal medication-related patient care and health outcomes.
- Furthermore, information technology (IT) and pharmacy informatics are intricately linked because IT tools provide the infrastructure for information management to support pharmacy informatics.

Brent I. Fox, Rachel Bongiorno Karcher, Allen Flynn, and Sandi Mitchell (2008). Pharmacy Informatics Syllabi in Doctor of Pharmacy Programs in the US. American Journal of Pharmaceutical Education: Vol 72, Issue 4, Article 89

ASHP Statement on the Pharmacist's Role in Informatics

Education

- Pharmacy informaticists need to develop a set of practical informatics competencies to manage **medication-related data and information** challenges across the continuum of health care.
- Only a small percentage of U.S. pharmacy students currently receive the level of exposure to medical informatics needed to prepare for the dawning "decade of health information technology."

ASHP statement on the pharmacist's role in informatics. Am J Health-Syst Pharm. 2007; 64:200–3.

2007 Accreditation Council for Pharmacy Education Standards

Informatics

- basic terminology (data, information, knowledge, hardware, software, networks, information systems, information systems management)
- reasons for systematic processing of data, information and knowledge in health care
- use of data in continuous quality improvement initiatives
- benefits and current constraints in using information and communication technology in health care

ASHP Statement on the Pharmacist's Role in Informatics

- Coordination and implementation of staff development programs and curricula in pharmacy departments designed to teach fundamental concepts related to technology and outline those areas of medical informatics in which pharmacists are critical to the development process (e.g., electronic prescribing and ordering, clinical decision support, drug administration).

ASHP statement on the pharmacist's role in informatics. Am J Health-Syst Pharm. 2007; 64:200–3.

2007 Accreditation Council for Pharmacy Education Standards

Drug Information

- fundamentals of the practice of drug information
- application of drug information skills for delivery of pharmaceutical care
- technology of drug information retrieval for quality assurance
- the ability to judge the reliability of various sources of information

Literature Evaluation and Research Design

- fundamentals of research design and methodology
- principles of evaluation of the primary literature
- practical implications of the primary literature
- principles of research design and analysis in practicing evidence-based pharmacy
- levels of clinical evidence

Pharmacy Practice Model Initiative- PPMI

Pharmacy departments utilize available automation and technology to improve patient safety and improve efficiency.

- 4.1. **computerized prescriber order entry** (CPOE) system with **clinical decision support** for inpatient medication orders.
- 4.2. **machine readable coding** (e.g., bar coding technology with/out robot) in the inpatient pharmacy to **verify doses during dispensing**.
- 4.3. **automated dispensing technologies** (e.g., automated dispensing cabinets, robotics).
- 4.4 **smart infusion pumps** that are integrated into a closed loop medication-use process (i.e., where CPOE/pharmacy information system is integrated with pumps, and administration is documented on eMAR).
- 4.5. machine-readable coding (e.g., **Bar-Code Medication Administration** system) to verify the identity of the patient and the accuracy of medication administration **at the point-of-care**.

http://www.ashpmedia.org/ppmi/goal4.html

Health Professions Education: A Bridge to Quality

All Health Professionals Should be able to:

- Deliver patient-centered care
- Work in interdisciplinary teams
- Employ evidence-based practice
- Apply quality improvement approaches
- Utilize informatics

Health Professions Education: A Bridge to Quality (2003) Institute of Medicine (IOM). National Academy of Sciences.

Recent Additions to the Doctor of Pharmacy (Pharm.D.) Curricula

- Behavioral Modification, Motivational Interviewing
- Objective Structured Clinical Exams (OSCEs)
- Genetics, Molecular Biology, Pharmacogenomics
- **Bioinformatics, Healthcare/Pharmacy Informatics**
- Medication Therapy Management
- Pharmacoeconomics, Health Outcomes
- Public Health and Policy, Advocacy
- Interprofessional Education Experiences (IPEs)

Learning Activities to Incorporate Pharmacy Informatics - Curriculum

Table 1. Sample Learning Activities to Incorporate Pharmacy Informatics into the Curriculum

Prescribing	
Didactic course	Review components and fields of prescriptions Discuss legibility issues of written, verbal, and electronic prescriptions (e Prescribing) Discuss the rationale for structured data for e-Prescribing and computerized prescriber order entry (CPOE)
Skills laboratory/IPPE-APPE[a] rotation	Review clinical decision support options for prescribers Create and send e-Prescriptions and medication orders via CPOE Discuss technical and personnel challenges unique to e-Prescriptions/CPOE
Pharmacist Prescription Review	
Didactic course	Discuss the stepwise process to determine prescription appropriateness Discuss options to communicate with prescriber regarding received prescriptions Review relationship between product availability and product selection in received prescriptions Discuss the importance of prescription labeling as it relates to patient safety, including readability
Skills laboratory/IPPE-APPE rotation	Discuss options for and document interventions related to prescriptions (electronically and/or on paper) Experiment with clinical decision support options for pharmacists Search electronic resources for evidence based medicine, clinical tools, and drug information

Informatics in PharmD Curricula

Methods. Accredited pharmacy programs were contacted (Feb 2006). Didactic and experiential syllabi were analyzed for compliance with informatics competencies in Accreditation Council for Pharmacy Education (ACPE) Standards 2007.

Results. Thirty-two of 89 schools responded; 25 provided syllabi. The syllabi contained a diverse mix of educational content, some of which represented pharmacy informatics content as defined by ACPE. Schools are teaching clinical system terminology, applications, and evaluation.

Conclusions. Many professional programs are not providing instruction in pharmacy informatics. There may be confusion within the academy/profession between *pharmacy informatics* and *drug information practice*. **Much work is required for programs to become compliant with the ACPE 2007 pharmacy informatics competencies.**

Brent I. Fox, Rachel Bongiorno Karcher, Allen Flynn, and Sandi Mitchell (2008). Pharmacy Informatics Syllabi in Doctor of Pharmacy Programs in the US. American Journal of Pharmaceutical Education: Vol 72, Issue 4, Article 89

Learning Activities to Incorporate Pharmacy Informatics - Curriculum

Compounding and Dispensing	
Didactic course	Discuss the role, limitations, and benefits of dispensing automation for safe medication storage, preparation, and dispensing Watch a video describing IV robotics and automated IV workflow systems on how the technology prepares drug products while increasing safety
Skills laboratory	Print and scan barcodes; note challenges of scanning due to label size/shape of dosage form Observe process of loading automated dispensing machines (ADMs) Review operational reports and metrics; identify methods to improve drug preparation/dispensing workflow
IPPE-APPE rotation	Observe differences in nurse ADM workflow Use and discuss process of using barcode technology during inventory, drug preparation, and dispensing
HIT[b] vendor	Observe automated medication tracking systems from receiving through patient medication administration Review telepharmacy workflow to check a drug preparation remotely
Medication Administration	
Didactic course	Compare and contrast the benefits/limitations of paper and electronic medication administration records
Skills laboratory	Observe role of smart infusion pumps in patient safety and the development of drug libraries
IPPE-APPE rotation	Collaborate with nursing to review the 5 Rights of medication administration using automated systems Discuss/observe the role of auto ID patient identification tools in ensuring the 5 Rights
HIT vendor	Review workflow allowing for IV interoperability communication between EHR and smart infusion pumps

Technology in PharmD Education

Pharmacy has an established history of technology use to support business processes. Pharmacy informatics education within doctor of pharmacy programs, however, **is inconsistent, despite its inclusion as a requirement in the 2007 Accreditation Council for Pharmacy Education Standards and Guidelines.** This manuscript describes pharmacy informatics knowledge and skills that all graduating pharmacy students should possess, conceptualized within the framework of the medication use process. Additionally, we suggest core source materials and specific learning activities to support pharmacy informatics education. We conclude with a brief discussion of emerging changes in the practice model. These changes are facilitated by pharmacy informatics and will inevitably become **commonplace in our graduates' practice environment**.

Brent I. Fox, Allen J. Flynn, Christopher R. Fortier, and Kevin A. Clauson (2011). Knowledge, Skills, and Resources for Pharmacy Informatics Education. American Journal of Pharmaceutical Education: Vol75, Issue 5, Article 93.

Table 1. (Continued)

Monitoring of Ongoing Medication Therapies	
Didactic course	Discuss clinical documentation within the larger context of electronic health records Write clinical surveillance rules to identify potential adverse drug reactions and adverse drug events Discuss the rationale for structured clinical documentation as it relates to longitudinal medication monitoring
Skills laboratory	Observe the use of electronic clinical monitoring tools within community pharmacy software systems Discuss the various remote and mobile technologies to retrieve clinical information and medication database for use while on patient care rounds
IPPE-APPE rotation	Document patient intervention within organization pharmacy intervention system Discuss/observe medication monitoring technologies for use at the patient's residence Review real-time monitoring system that provides a work queue of patient needing review and intervention Enter a medication occurrence or adverse drug event report in organizations reporting system and determine how the reports are follow-up with
HIT vendor	Conduct a telepharmacy consultation that allows for interaction with a patient from a remote location Review ambulatory EHR patient profiles to incorporate information into an acute care EHR medication history
Overall	
Didactic course	Discuss positive and negative workflow implications of HIT Discuss role of HIT in pharmacy practice Describe human factors engineering to design and optimize safety and efficiency of technology Review security and privacy considerations for HIT Describe technology implementation project management principles for the assessment, build, implementation, maintenance, and optimization stages

[a] IPPE-APPE: Introductory pharmacy practice experience-Advanced pharmacy practice experience
[b] HIT: Health information technology. Vendors can provide tools, demonstrations, and real-world practical experience.

Emerging Pharmacist Activities with Medication Use Technologies

Table 2. Emerging Pharmacist Activities with Medication Use Technologies

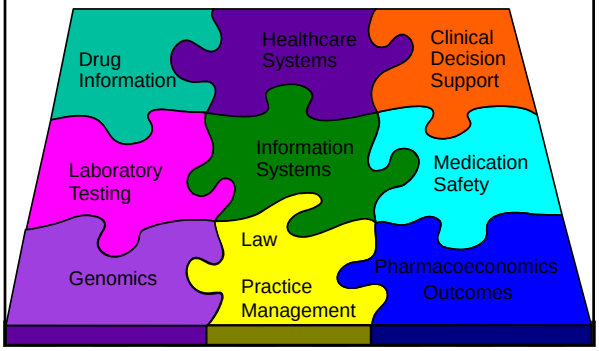
Domain	Technologies	Activities
Clinical Medication Management	Electronic health record (EHR)	• Participate in the development of the EHR to include the appropriate medication analysis and clinical decision support tools
	Clinical decision support (CDS)	• Develop requirements to be built into various medication use technologies to impact prescribing, prescription review, dispensing, and administration • Participate in designing electronic workspace systems that can provide real-time lists of potential interventions based on the patient's medications, lab values, renal function, drug interaction, etc.
	Computerized prescriber order entry (CPOE)	• Collaborate with informatics divisions and other clinicians to develop and build CDS, electronic order sets, and other components of CPOE
	Smart infusion pumps	• Provide clinical data and medication safety principles to develop and optimize smart infusion pump drugs libraries based on prescribing patterns and literature
	Pharmacy information management systems (PIMS)	• Incorporate more clinical management principles into these systems to improve drug selection, preparation, and dispensing
Preparation and Dispensing Management	Automated workflow systems	• To prepare for increased direct patient care roles, pharmacists will design automation workflows and quality processes for compounding and dispensing activities to be overseen by technicians
	Pharmacy information management systems (PIMS)	• Develop process and procedures around consistent remote order review and approval of doses using CPOE and automated workflow systems while on patient care rounds
	Medication tracking systems	• Develop/implement auto-identification systems to track medications from receipt, through preparation, distribution, and administration
	Analytics and metrics	• Consult on the distribution process data needed to audit and steer analytic processes to improve operational efficiencies

Approaches Learning Informatics

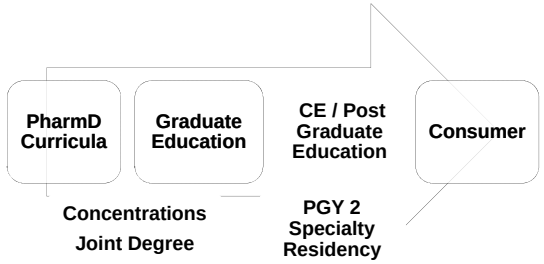
- Pedagogical Approaches
  - Self-Directed Learning
  - Group-Based/Active Learning
  - Problem-Based Learning (PBL)
- Workshops/Laboratory
  - Case-Based, Hands-on Experiences
  - Objective Structured Informatics Examinations (OSIE's)

- Use of Technology
  - "Hands On"
  - Web-based
  - Computer Assisted Instruction
  - Synchronous and Asynchronous modes
- Experiential
  - IPPEs
  - APPEs

Integration of Academic Disciplines Around Pharmacy Informatics



Positioning Informatics in Academic Pharmacy



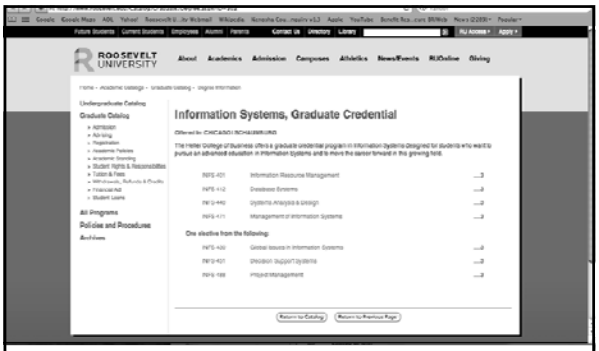
Learning Activities	
Prescribing	e-Prescribing, CPOE, EHRs
Prescription Review	document interventions clinical decision support (CDS)
Compounding and Dispensing	IV robotics (sterile products) automated dispensing machines bar code technology
Medication Administration	medication administration records (elec) smart infusion pumps auto-ID patient identification tools, BCMA
Monitoring of Ongoing Medication Therapies	clinical documentation, telephonic EHR patient profiles, documentation ambulatory monitoring devices

RUCOP PharmD

- Health Care Systems and Medication Safety
- Biostatistics and Pharmacoepidemiology
- Medication Use Systems & Health Care Informatics
- Practice Management and Medication Therapy MTG
- Public Health and Health Policy
- Health Economics and Outcomes Assessment
- Pharmacy Law

College of Business Concentrations

- Business Analysis
- Strategic Management
- Human Resource Management
- Managerial Leadership
- Information Systems



"Nanotainer"

Micro-blood sample as small as a few drops – 1/1,000 the size of a typical blood draw, taken from a tiny finger stick.

Prices are often a half to a quarter of what independent labs charge, and a quarter to a 10th of what hospital labs bill: blood typing $2.05; cholesterol $2.99; iron $4.45, fertility panel $35

Disruption….

comes from cheaper and simpler technologies that are initially of lower quality. Over time, simpler and cheaper technology improves to a point that it displaces the incumbent.

"No one thinks of the lab-testing experience as positive. It should be! One way to create that is to help people engage with the data once their physicians release it."

Elizabeth Holmes CEO and Founder Theranos (age 30)

Question: What or Who is the Incumbent being Displaced?

Example: Theranos - a potentially highly disruptive upstart in America's $73 billion diagnostic-lab industry, which performs nearly 10 billion tests a year. Theranos is now valued at $9 billion.

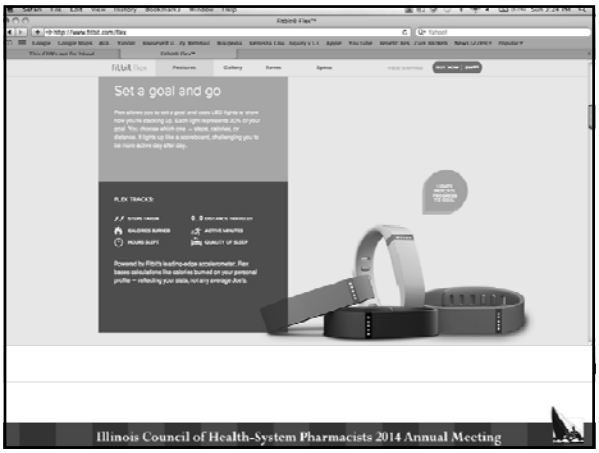
3 November 2013

Theranos and Walgreens Expand Diagnostic Lab Testing to the Phoenix Metropolitan Area

New Theranos Wellness Centers at Walgreens stores provide consumers with less invasive, fast, affordable testing on samples as small as a few drops of blood.

Now at 23 Walgreens in Phoenix

Next: UCSF Medical Center, Dignity Health's 21-state hospital group, and Intermountain Healthcare's 22-hospital system in Utah and Idaho.



Illinois Council of Health-System Pharmacists 2014 Annual Meeting

Paradigm shift from "population" practice of medicine to "personalized" medicine through biosensors, bioinformatics, pharmacogenomics and digital devices.

The Creative Destruction of Medicine....How the digital revolution will create better health care Eric Topol, M.D. 2012

The Pharmacy Profession is well positioned to manage healthcare technologies, point of care diagnostics, pharmacogenomics, biological sensors, and outcomes related to medications.

G.E. MacKinnon, PhD, RPh

Illinois Council of Health-System Pharmacists 2014 Annual Meeting

Bluetooth Weight Scale

Blood Glucose Meter App

ECG App

Digital Monitoring Devices & Apps to Improve Adherence/Outcomes

Blood Pressure Cuff

Medication Reminders

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There is little impetus for the inclusion of informatics in Pharmacy Curricula from ACPE Accreditation Standards or Professional Organization such as IOM or AMIA?

A. True
B. False

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Pharmacists play a critical role in medical informatics in which of the following processes:

A. Electronic prescribing/ordering
B. Clinical decision support
C. Drug administration
D. All of the above

Illinois Council of Health-System Pharmacists 2014 Annual Meeting