



## Sample Informatics APPE Student Rotation

### *Disclaimer*

*This Informatics Student Rotation Tool proposes a comprehensive approach, and thus it can/should be pared down accordingly by programs for use.*

### ***Rotation Description***

The Informatics rotation will help students become familiar with the key principles utilized in hospitals and health systems to improve pharmacy informatics, automation and health information technology. The rotation is designed to expose students to Informatics nomenclature, key principles, tools and available resources. The student will participate in several activities designed to improve the student's working knowledge and experience with Informatics concepts. The rotation will enable the student to apply knowledge in any pharmacy practice setting to improve technology used to provide patient care.

### ***Goals and Objectives***

The preceptor and student should agree on which goals and objectives are appropriate for the rotation based on rotation site, rotation objectives delineated by School/College of Pharmacy, rotation length and student interests. The following are a list of potential goals and objectives:

1. Demonstrate understanding of basic pharmacy informatics principles, standards, and best practices.
2. Describe currently available automated technology for order processing, safe and efficient distribution, dispensing, and administration of medications, documentation of medication administration, electronic surveillance systems for effects monitoring, pharmacy inventory management systems, and emerging technology and automation systems that assist with the medication-use system.
3. Understand the steps necessary for the implementation of a new pharmacy technology and medication use systems.
4. Describe the process of mining, aggregating, analyzing, and interpreting data from clinical information systems to improve patient outcomes.
5. Describe the process of documentation, formal testing procedures for data and transactional verification and/or validation.
6. Explain the principles of decision support as they apply to health care providers making direct patient-care decisions and their effect on medication safety.
7. Describe how informatics and technology relate to patient safety in the medication use process.
8. Describe the flow of orders within the health system and indicate points of potential failure and how technology can enhance patient safety. Observe the workflow of central and decentralized pharmacy operations with regard to technology and informatics, and demonstrate proficiency with using automation in dispensing medications safely.
9. Explain security and patient protections such as access control, data security, data encryption, HIPAA privacy regulations, as well as ethical and legal issues related to the use of information technology in pharmacy practice.
10. Evaluate/Identify opportunities for improving operational efficiencies in order to better serve patient and health professional needs through the application of informatics principles, standards, and best practices.

11. Describe how issues or enhancement requests are identified and communication to the software vendor(s)
12. Communicate effectively and professionally with other clinical informatics staff, both written and verbal
13. Display independent self-learning in the field of pharmacy informatics

### ***Activities***

During the course of the rotation, the student should participate in some of the following activities as assigned by preceptor:

1. Watch at least one of the following videos and discuss impressions with the preceptor:
  - a. ASHP: What is Pharmacy Informatics
  - b. Overview of Safety Recommendations for Medication Management TechnologyWrite a reflection after watching each video
2. Complete orientation to organization's pharmacy operations and clinical activities. The student will spend time (e.g., one week) working with pharmacy technicians in pharmacy operations and working with clinical pharmacists on the nursing units (refer to the sample checklist provided). The student will provide a written summary of daily activities that should include (at a minimum) answers to the following questions:
  - a. Describe *differences* noticed between organization's practice and practices you have been exposed to previously.
  - b. Describe *similarities* between organization's practice and practices you have been exposed to previously.
  - c. Describe unsafe/risky technology practices you witnessed during periods of observation.
  - d. Describe safe technology practices you witnessed during periods of observation.
  - e. Provide any suggestions for process improvements to improve health system informatics and automated technology.
3. Explore Computerized Prescriber Order Entry (CPOE) systems for electronic medication ordering integrated with electronic health records (EHRs), pharmacy information systems and clinical decision support tools that bring best practice information and guidelines to clinicians at the time it is needed and rules-based systems for monitoring, evaluating, responding, and reconciling medication-related events and information.
4. Complete a pharmacy informatics- related journal article review and journal club presentation during rotation.
5. Compile a summary of the pharmacy informatics, issues affecting the hospital and potential risk reduction strategies that should be considered for implementation.
6. Review pharmacy informatics resources:
  - a. Agency for Healthcare Research and Quality (AHRQ)
  - b. American Medical Informatics Association (AMIA)
  - c. American Society of Health System Pharmacists (ASHP)
  - d. Certification Commission for Healthcare Information Technology (CCHIT)
  - e. Healthcare Information and Management Systems Society (HIMSS)
  - f. Health Level Seven International

7. Expose the student to the following activities from pharmacists, nurses and IT staff perspective: medication administration, smart pump programming, documentation on (electronic) medication administration record (MAR), use of and issues associated with automated dispensing cabinets (ADCs) and bar code at the point of care (BPOC). The student should note safe practices, unsafe practices, teamwork and communication issues, workflow issues (e.g., distractions and interruptions, missing medications) and opportunities for pharmacy to help improve safety. The student should provide a written summary of the experience and present to pharmacy staff.
8. Read necessary/assigned materials and be prepared to discuss with the preceptor during topic discussions. Prepare and lead at least one topic discussion on a relevant pharmacy informatics related topic.
9. Participate in training sessions with other department staff.
10. Attend all assigned pharmacy and interdisciplinary meetings relative to Informatics, such as:
  - a. Clinical Informatics Committee
  - b. Clinical Services/Tech Meetings
  - c. CPOE Committee
  - d. Electronic Health Records Operational Meetings
  - e. Formulary Subcommittee
  - f. Interdisciplinary Informatics Committees
  - g. P & T Committee
  - h. Patient Safety Committee
  - i. Pharmacy Medication Management meeting
  - j. Pharmacy Practice Meeting
  - k. Screen Team
  - l. Various other meetings as directed
11. Complete other activities as assigned by preceptor.

### ***Topic Discussions***

As time permits, preceptors should schedule time when they can discuss various topics with the student. Background readings should be provided when available (some suggested readings listed with topics in this section). The student should be expected to lead at least one topic discussion towards the end of the rotation.

## Potential Topics

Clinical Decision Support Systems	<ul style="list-style-type: none"><li>• A Pragmatic Approach to Implementing Best Practices for Clinical Decision Support Systems in Computerized Provider Order Entry Systems. Peter A. Gross, David W. Bates. <i>J Am Med Inform Assoc.</i> 2007;14:25-28.</li><li>• Computerized Physician Order Entry with Clinical Decision Support in Long-Term Care Facilities: Costs and Benefits to Stakeholders. Subramanian S, et. al.. <i>Journal of the American Geriatrics Society.</i> 2007 Sep;55(9):1451-1457.</li><li>• Development of an intelligent decision support system for medication review. I. K. Bindoff, C. Tenni MPharm, G. M. Peterson, B. H. Kang, L. Jackson. <i>Journal of Clinical Pharmacy and Therapeutics.</i> 2007 Feb;32(1):81-88.</li><li>• Exposure to Automated Drug Alerts Over Time: Effects On Clinicians' Knowledge And Perceptions. Glassman P., Belperio P, Simon B, Lanto A, Lee M. <i>Medical Care.</i> 2006 March;44(3):250-256.</li><li>• Medication-related clinical decision support in computerized provider order entry systems: a review. Kuperman GJ, Bobb A, Payne TH, Avery AJ, Gandhi TK, Burns G, Classen DC, Bates DW. <i>J Am Med Inform Assoc.</i> 2007 Jan-Feb;14(1):29-40.</li><li>• Pharmacist Workload and Pharmacy Characteristics Associated With the Dispensing of Potentially Clinically Important Drug-Drug Interactions. Malone D, et. al.. <i>Medical Care.</i> 2007 May;45(5):456-462.</li><li>• Turning off frequently overridden drug alerts: limited opportunities for doing it safely. van der Sijs H, Aarts J, van Gelder T, Berg M, Vulto A. <i>J Am Med Inform Assoc.</i> 2008 Jul-Aug;15(4):439-48. Epub 2008 Apr 24.</li><li>• Use of Clinical Decision Support to Increase Influenza Vaccination: Multi-year Evolution of the System. Gerard M, Trick W, Das K, Charles-Damte M, Murphy G, Benson I. <i>J Am Med Inform Assoc.</i> 2008 Aug 28.</li><li>• Use of ComputerDecision Support Interventions to Improve Medication Prescribing in Older Adults: A Systematic Review. Yourman L, Concato J, Agostini J. <i>Am J of Geriatric Pharmacotherpay.</i> 2008 Jun;6(2):119-129.</li></ul>
Computerized Provider Order Entry (CPOE)	<p><b>Guidelines &amp; Statements</b></p> <ul style="list-style-type: none"><li>• ASHP Guidelines: Pharmacy Planning for Implementation of Computerized Provider-Order-Entry Systems in Hospitals and Health Systems (<a href="http://www.ashp.org/DocLibrary/BestPractices/AutoITGdICPOE.aspx">http://www.ashp.org/DocLibrary/BestPractices/AutoITGdICPOE.aspx</a>)</li><li>• General Principles for Purchase and Safe Use of CPOE Systems (<a href="http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/General-Principles-for-Computerized-Prescriber.aspx">http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/General-Principles-for-Computerized-Prescriber.aspx</a>)</li><li>• Landmines and Pitfalls of CPOE (<a href="http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/Landmines-and-Pitfalls.aspx">http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/Landmines-and-Pitfalls.aspx</a>)</li></ul> <p><b>Implementation</b></p> <ul style="list-style-type: none"><li>• An assessment of Health Care Information and Management Systems Society and Leapfrog data on computerized provider order entry. Diana ML, Kazley AS, Menachemi N. <i>Health Serv Res.</i> 2011 Oct;46(5):1575-91.</li><li>• Characteristics of CPOE systems and obstacles to implementation that physicians believe will affect adoption. Singh D, Spiers S, Beasley BW. <i>South Med J.</i> 2011 Jun;104(6):418-21.</li><li>• Computer physician order entry: Benefits, costs, and issues. Kuperman GJ, Gibson RF. <i>Ann Intern Med.</i> 2003; 139: 31-9.</li><li>• Computerized prescriber order-entry systems: evaluation, selection, and implementation. Gray MD, Felkey BG. <i>American Journal of Health System Pharmacy.</i> 2004; 61(2): 190-7.</li><li>• Consensus Recommendations for Basic Monitoring and Evaluation of In-patient Computer-based Provider Order Entry Systems. Dean F. Sittig, Sean M. Thomas, Emily Campbell, et. al. 2007. <i>ITCH.</i></li><li>• Critical drug-drug interactions for use in electronic health records systems with computerized physician order entry: review of leading approaches. Classen DC, Phansalkar S, Bates DW. <i>J Patient Saf.</i> 2011 Jun;7(2):61-5.</li><li>• Electronic prescribing at the point of care: a time-motion study in the primary care setting. Devine EB, Hollingworth W, Hansen RN. <i>Health Serv Res.</i> 2010 Feb;45(1):152-71.</li><li>• Evaluation and Certification of Computerized Provider Order Entry Systems. David C. Classen, Anthony J. Avery, David W. Bates. <i>J Am Med Inform Assoc.</i> 2007;14:48-55.</li><li>• Hospital implementation of computerized provider order entry systems: results from the 2003 leapfrog group quality and safety survey. Hillman JM, Given RS. <i>Journal of Healthcare Information Management.</i> 2005; 19(4): 55-65.</li><li>• Implementation of Computerized Physician Order Entry in Seven countries. Jos Aarts and Ross Koppel. <i>Health Aff (Millwood).</i> 2009 Mar-Apr;28(2):404-14.</li><li>• Implementation of hospital computerized physician order entry systems in a rural state: Feasibility and financial impact. Ohsfeldt RL, Ward MM, Schneider JE, et.al. <i>J Am Med Inform Assoc.</i> 2005 Jan-Feb; 12(1): 20-7.</li><li>• Meaningful use of computerized prescriber order entry. Classen D, Bates DW, Denham CR. <i>J Patient Saf.</i> 2010 Mar;6(1):15-23.</li></ul>

- Medication administration quality and health information technology: a national study of US hospitals. Appari A, Carian EK, Johnson ME, Anthony DL. *J Am Med Inform Assoc.* 2011 Oct 28.
- Pharmacists' perceptions of computerized prescriber-order-entry systems, Inquilla CC, Szeinbach S, Seoane-Vazquez E, Kappeler KH, *Am. J. Health Syst. Pharm.*, Aug 2007; 64: 1626 - 1632.
- Randomized clinical trial of a customized electronic alert requiring an affirmative response compared to a control group receiving a commercial passive CPOE alert: NSAID--warfarin co-prescribing as a test case. Strom BL, Schinnar R, Bilker W, Hennessy S, Leonard CE, Pifer E. *J Am Med Inform Assoc.* 2010 Jul-Aug;17(4):411-5.
- Safe and successful implementation of CPOE for chemotherapy at a children's cancer center. Hoffman JM, Baker DK, Howard SC, Laver JH, Shenep JL. *J Natl Compr Canc Netw.* 2011 Feb;9 Suppl 3:S36-50.
- Strategies for pharmacy integration and pharmacy information system interfaces, Part 1: History and pharmacy integration options. Chaffee BW and Bonasso J. *Am J Health Syst Pharm.* March 1, 2004 61:502-506.
- Strategies for pharmacy integration and pharmacy information system interfaces, Part 2: Scope of work and technical aspects of interfaces. Chaffee BW and Bonasso J. *Am J Health Syst Pharm.* March 1, 2004 61:506-514.

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**Post-Implementation & Its Impact**

- Adding insight: a qualitative cross-site study of physician order entry. Ash JS, Sittig DF, Seshadri V, et al. *International Journal of Medical Informatics.* 2005; 74(7-8): 623-8.
- Development of the Leapfrog methodology for evaluating hospital implemented inpatient computerized physician order entry systems. *Qual. Saf. Health Care*, April 1, 2006; 15(2): 81 - 84.
- Emotional aspects of computer-based provider order entry: a qualitative study. Sittig DF, Krall M, Kaalaas-Sittig J, Ash JS. *Journal of the American Medical Informatics Association.* 2005; 12(5): 561-7.
- Impact of Vendor Computerized Physician Order Entry in Community Hospitals. Leung AA, Keohane C, Amato M, et. al. *J Gen Intern Med.* 2012 Jan 21.
- Improved compliance with quality measures at hospital discharge with a computerized physician order entry system. Butler J, Speroff T, Arbogast PG, et al. *American Heart Journal.* 2006; 151(3): 643-53.
- Medication Administration Variances Before and After Implementation of Computerized Physician Order Entry in a Neonatal Intensive Care Unit. Taylor J, Loan L, Kamara J, Blackburn S, Whitney D. *Pediatrics.* 2008 Jan;121(1):123-128.
- Outcomes of computerized physician order entry in an electronic health record after implementation in an outpatient oncology setting. Harshberger CA, Harper AJ, Carro GW, et. al. *J Oncol Pract.* 2011 Jul;7(4):233-7.
- Return on investment for a computerized physician order entry system. Kaushal R, Jha AK, Franz C, et al. *J Am Med Inform Assoc.* May-June 2006; 13(3): 261-6.

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**Patient Safety and Medication Errors**

- A Risk Analysis Method to Evaluate the Impact of a Computerized Provider Order Entry System on Patient Safety. Bonnarby P, et. al. *J Am Med Inform Assoc.* 2008;15:453-460.
  - Comprehensive Analysis of a Medication Dosing Error Related to CPOE. Jan Horsky, Gilad J. Kuperman, and Vimla L. Patel. *J. Am. Med. Inform. Assoc.* 12: 377-382
  - Computerized physician order entry- based hyperglycemia inpatient protocol and glycemic outcomes: The CPOE-HIP study. Guerra YS, Das K, Antonopoulos P, et. al. *Endocr Pract.* 2010 May-Jun;16(3):389-97.
  - Computerized provider order entry in pediatric oncology: design, implementation, and outcomes. Chen AR, Lehmann CU. *J Oncol Pract.* 2011 Jul;7(4):218-22.
  - Effect of a computerized prescriber-order-entry system on reported medication errors. Spencer DC, Leininger A, Daniels R, Granko RP, Coeytaux RR, *Am. J. Health Syst. Pharm.*, Feb 2005; 62: 416 - 419.
  - Effects of an integrated clinical information system on medication safety in a multi-hospital setting, Mahoney CD, Berard-Collins CM, Coleman R, Amaral JF, Cotter CM, *Am. J. Health Syst. Pharm.*, Sep 2007; 64: 1969 - 1977.
  - Effects of therapeutic drug monitoring criteria in a computerized prescriber-order-entry system on the appropriateness of vancomycin level orders. Traugott KA, Maxwell PR, Green K, Frei C, Lewis JS 2nd. *Am J Health Syst Pharm.* 2011 Feb 15;68(4):347-52.
  - Error reduction in pediatric chemotherapy: computerized order entry and failure modes and effects analysis. Kim GR, Chen AR, et al. *Arch Pediatr Adolesc Med.* 2006 May;160(5):495-8.
  - Preventing potentially inappropriate medication use in hospitalized older patients with a computerized provider order entry warning system. Mattison ML, Afonso KA, Ngo LH, Mukamal KJ. *Arch Intern Med.* 2010 Aug 9;170(15):1331-6.
  - Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors. Ross Koppel. Joshua P. Metlay; Abigail Cohen; Brian Abaluck; A. Russell Localio; Stephen E. Kimmel; Brian L. Strom *JAMA.* 2005;293(10):1197-1203.
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**Unintended Consequences of CPOE**

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- Factors contributing to an increase in duplicate medication order errors after CPOE implementation. Wetterneck TB, Walker JM, Blosky MA, Cartmill RS, Hoonakker P, Johnson MA, Norfolk E, Carayon P. *J Am Med Inform Assoc.* 2011 Nov-Dec;18(6):774-82.
- In reply to: "e-litrogenesis: The most critical consequence of CPOE and other HIT". Emily M. Campbell, Dean F. Sittig, Joan S. Ash, Kenneth P. Guappone, Richard H. Dykstra. *J Am Med Inform Assoc.* 2007;14:389.
- Medication administration discrepancies persist despite electronic ordering. FitzHenry F, Peterson JF, Arrieta M, Waitman LR, Schildcrout JS, Miller RA. *J Am Med Inform Assoc.* 2007 Nov-Dec;14(6):756-64.
- Provider and pharmacist responses to warfarin drug-drug interaction alerts: a study of healthcare downstream of CPOE alerts. Miller AM, Boro MS, Korman NE, Davoren JB. *J Am Med Inform Assoc.* 2011;18:i45-i50.
- The extent and importance of unintended consequences related to computerized provider order entry. Ash JS, Sittig DF, Poon EG, Guappone K, Campbell E, Dykstra RH. *J Am Med Inform Assoc.* 2007 Jul-Aug;14(4):415-23.
- The unintended consequences of computerized provider order entry: Findings from a mixed methods exploration, Ash JS, Sittig DF, Dykstra R, Campbell E, Guappone K. *Int J Med Inform.* 2009 April. 78:1:S69-S76.
- Time-dependent drug-drug interaction alerts in care provider order entry: software may inhibit medication error reductions. Van der Sijs H, Lammers L, van den Tweel A, Aarts J, Berg M, Vulto A, van Gelder T. *J Am Med Inform Assoc.* 2009 Nov-Dec;16(6):864-8.
- Types of Unintended Consequences Related to Computerized Provider Order Entry. Emily M. Campbell, Dean F. Sittig, Joan S. Ash, Kenneth P. Guappone, Richard H. Dykstra. *J Am Med Inform Assoc.* 2006;13:547-556.
- Unexpected increased mortality after implementation of a commercially sold computerized physician order entry system. Han YY, Carcillo JA, Venkataraman ST, Clark RS, Watson RS, Nguyen TC, Bayir H, Orr RA. *Pediatrics.* 2005; 116(6): 1506-12.
- Unintended effects of a computerized physician order entry nearly hard-stop alert to prevent a drug interaction: a randomized controlled trial. Strom BL, Schinnar R, Aberra F, Bilker W, Hennessy S, Leonard CE, Pifer E. *Arch Intern Med.* 2010 Sep 27;170(17):1578-83.

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**eHealth Initiatives (Telepharmacy)**

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- Hospital Telepharmacy Network: Delivering Pharmacy Services to Rural Hospitals. Peterson C, Rathke A, Skwieria J, Anderson H. *J Pharm Technol* 2007;23:158-65.
- Implementation of pharmacy services in a telemedicine intensive care unit. Meidl T, Woller T, Iglar A, Brierton. *American Journal of Health-System Pharmacy* 2008; 65(15): 1464-1469.
- Telepharmacy at a critical access hospital. Boon A. *Am. J. Health Syst. Pharm.,* Feb 2007; 64: 242 - 244.

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**Electronic Health Records & Clinical Documentation**

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- AHRQ - Electronic Medical Record
- Electronic Health Records: A Global Perspective. Arnold S, Wagner J, Hyatt S, Klein G. HIMSS White paper Executive Summary.
- Electronic Medical Records vs. Electronic Health Records: Yes, There Is a Difference. Garets D, Davis M. A HIMSS Analytics™ White Paper. Updated January 26, 2006.
- Usefulness of a large automated health records database in pharmacoepidemiology. Hashikata H, Harada KH, Kagimura T, Nakamura M, Koizumi A. *Environ Health Prev Med.* 2011 Sep;16(5):313-9.

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**Informatics and Patient Safety**

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- A controlled trial of smart infusion pumps to improve medication safety in critically ill patients. Rothschild JM, Keohane CA, Cook EF, et al. *Crit Care Med.* 2005;33:533-540.
  - AHRQ Making Health Care Safer: A Critical Analysis of Patient Safety Practices. Chapter 6. Computerized Physician Order Entry (CPOE) with Clinical Decision Support Systems (CDSSs) (<http://www.ahrq.gov/clinic/ptsafety/chap6.htm>)
  - AHRQ Making Health Care Safer: A Critical Analysis of Patient Safety Practices. Chapter 11. Automated Medication Dispensing Devices (<http://www.ahrq.gov/clinic/ptsafety/chap11.htm>)
  - Deploying information technology and continuous control monitoring systems in hospitals to prevent medication errors. Escobar-Rodríguez T, Monge-Lozano P, Romero-Alonso MM, Bolívar-Raya MA. *HIM J.* 2012;41(1):17-25
  - Implementation and Optimization of Smart Infusion Systems: Are we Reaping the Safety Benefits? Trbovich PL, Cafazzo JA, Easty AC. *J Healthc Qual.* 2011 Nov 21.
  - Insights from the sharp end of intravenous medication errors: implications for infusion pump technology (<http://qualitysafety.bmj.com/content/14/2/80.full.pdf+html>)
  - Medication errors in inpatient pharmacy operations and technologies for improvement, Kuiper SA, McCreadie SR, Mitchell JF, Stevenson JG, *Am. J. Health Syst. Pharm.,* May 2007; 64: 955 - 959.
  - Medication errors: prevention using information technology systems (<http://onlinelibrary.wiley.com/doi/10.1111/j.1365-2125.2009.03427.x/pdf>)
  - Pharmacists and health information technology: emerging issues in patient safety. Fuji KT, Galt KA. *HEC Forum.* 2008;20:259-275.
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	<ul style="list-style-type: none"> <li>• Smart Infusion Pump Technology: Don't Bypass the Safety Catches (<a href="http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2007/dec4(4)/documents/139.pdf">http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2007/dec4(4)/documents/139.pdf</a>)</li> <li>• The Effect of Electronic Prescribing on Medication Errors and Adverse Drug Events: A Systematic Review, Ammenwerth E, Schnell-Inderst P, Machan C, Siebert U, J. Am. Med. Inform. Assoc., September 1, 2008; 15(5): 585 - 600.</li> <li>• What do we know about financial returns on investments in patient safety? A Literature Review. Schmidek JM, Weeks WB. Joint Commission Journal on Quality and Patient Safety. 2005 Dec; 31(10): 690-699.</li> </ul>
Information Management	<p><b>HIPAA &amp; Privacy</b></p> <ul style="list-style-type: none"> <li>• U.S. Department of Health and Human Services. Office of Civil Rights. HIPAA Administrative Simplification. Combined Regulation Text of All Rules. 45 CFR Parts 160, 162, and 164. <a href="http://www.hhs.gov/ocr/privacy/hipaa/administrative/combined/index.html">www.hhs.gov/ocr/privacy/hipaa/administrative/combined/index.html</a>.</li> <li>• U.S. Department of Health and Human Services. Office of the Secretary. 45 CFR Parts 160 and 164. Standards for privacy of individually identifiable health information. Office for Civil Rights, HHS. Final rule. Federal Register. 2002;67(157):53182-53273.</li> <li>• U.S. Department of Health and Human Services. Office of the Secretary. 45 CFR Parts 160, 162, and 164. Health insurance reform: security standards. Centers for Medicare &amp; Medicaid Services (CMS), HHS. Final rule. Federal Register. 2003;68(34)8334-8381.</li> <li>• U.S. Department of Justice. Drug Enforcement Administration. 21 CFR Parts 1300, 1304, 1306, and 1311. Electronic prescriptions for controlled substances. Interim final rule. Federal Register. 2010;75(61):16236-6319.</li> </ul> <p><b>Information Security</b></p> <ul style="list-style-type: none"> <li>• Burr WE, Dodson DF, Polk WT. NIST Special Publication 800-63 Version 1.0.2. Electronic authentication guideline. <a href="http://csrc.nist.gov/publications/nistpubs/800-63/SP800-63V1_0_2.pdf">http://csrc.nist.gov/publications/nistpubs/800-63/SP800-63V1_0_2.pdf</a></li> </ul> <p><b>Use of Databases for Data Mining (Medication Use Evaluations, QI/QA projects)</b></p> <ul style="list-style-type: none"> <li>• MUE Toolkit (<a href="http://www.pbm.va.gov/vamedsafe/MUE%20Toolkit.pdf">www.pbm.va.gov/vamedsafe/MUE%20Toolkit.pdf</a>)</li> <li>• AHRQ Tools and Strategies for Quality Improvement and Patient Safety (<a href="http://www.ahrq.gov/qual/nursesdbk/docs/HughesR_QMBMP.pdf">www.ahrq.gov/qual/nursesdbk/docs/HughesR_QMBMP.pdf</a>)</li> </ul>
Pharmacy Automation	<ul style="list-style-type: none"> <li>• ASHP Advantage CE: Improving Medication Safety in Health Systems through Innovations in Automation Technology (<a href="http://www.hospitalrx.com/pdf/ASHP%20Smart%20Pumps.pdf">http://www.hospitalrx.com/pdf/ASHP%20Smart%20Pumps.pdf</a>)</li> <li>• ASHP Guidelines on the Safe Use of Automated Medication Storage and Distribution Devices</li> <li>• ASHP national survey of pharmacy practice in hospital settings: Dispensing and administration 2011 (<a href="http://www.ajhp.org/content/69/9/768.full.pdf+html">http://www.ajhp.org/content/69/9/768.full.pdf+html</a>)</li> <li>• Ensuring the Smart Use of Smart Pumps. (<a href="http://www.pppmag.com/download.php?file=documents/V8N3/PPP_0311_SmartPumps.pdf">http://www.pppmag.com/download.php?file=documents/V8N3/PPP_0311_SmartPumps.pdf</a>)</li> <li>• FDA White Paper on Infusion Pump Improvement Initiative. April 2010. (<a href="http://www.fda.gov/downloads/MedicalDevices/ProductsandMedicalProcedures/GeneralHospitalDevicesandSupplies/InfusionPumps/UCM206189.pdf">http://www.fda.gov/downloads/MedicalDevices/ProductsandMedicalProcedures/GeneralHospitalDevicesandSupplies/InfusionPumps/UCM206189.pdf</a>)</li> <li>• Impact of Smart Infusion Technology on Administration of Anticoagulants (Unfractionated Heparin, Argatroban, Lepirudin, and Bivalirudin). Fanikos J, Fiumara K, Baroletti S, Luppi C, Saniuk C, Mehta A, Silverman J, Goldhaber S. Am J of Cardiology. 2007 Apr 1;99(7):1002-1005.</li> <li>• Institute for Safe Medication Practices (ISMP): Effective Approaches to Standardization and Implementation of Smart Pump Technology (<a href="http://www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf">http://www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf</a>)</li> <li>• Institute for Safe Medication Practices (ISMP): Guidance on the Interdisciplinary Safe Use of Automated Dispensing Cabinets</li> <li>• Increasing the use of 'smart' pump drug libraries by nurses: a continuous quality improvement project. Harding AD. Am J Nurs. 2012 Jan;112(1):26-35</li> <li>• Robots expand delivery options with seamless integration. A growing number of forward-thinking hospitals in search of greater efficiencies are embracing automated delivery robots. Zini A. Health Manag Technol. 2011 Mar;32(3):10-2.</li> <li>• Smart Pumps: Advanced Capabilities and Continuous Quality Improvement (<a href="http://www.psqh.com/janfeb07/smartpumps.html">http://www.psqh.com/janfeb07/smartpumps.html</a>)</li> <li>• Transition to new automated dispensing cabinets at two tertiary care hospitals (<a href="http://www.ajhp.org/content/68/13/1200.full.pdf+html">http://www.ajhp.org/content/68/13/1200.full.pdf+html</a>)</li> </ul>

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**Guidelines and Statements**

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- ASHP Statement on Bar-Code Enabled Medication Administration Technology (<http://www.ashp.org/DocLibrary/BestPractices/AutoITStBCMA.aspx>)
- ASHP Statement on Bar-Code Verification During Inventory, Preparation, and Dispensing of Medications (<http://www.ashp.org/DocLibrary/BestPractices/AutoITStBCVerif.aspx>)
- Veterans Affairs Best Practice Recommendations for the Implementation and Use of Bar Code Medication Administration (BCMA)

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**Pharmacy**

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- Cost-benefit analysis of a hospital pharmacy bar code solution (<http://archinte.ama-assn.org/cgi/content/full/167/8/788>)
- Development of a training program for bar-code-assisted medication administration in inpatient pharmacy (<http://www.ajhp.org/content/67/19/1592>)
- Medication Dispensing Errors and Potential Adverse Drug Events before and after Implementing Bar Code Technology in the Pharmacy (<http://www.annals.org/content/145/6/426.abstract>)
- Program to improve bar-code print quality (<http://www.ajhp.org/content/67/7/511>)

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**Nursing Impact**

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- Bar-code technology for medication administration: medication errors and nurse satisfaction. Fowler SB, Sohler P, Zarillo DF. *Medsurg Nurs.* 2009 Mar-Apr;18(2):103-9.
- Effect of bar-code-assisted medication administration on nurses' activities in an intensive care unit: a time-motion study (<http://www.ajhp.org/content/68/11/1026.full.pdf+html>)
- Impact of barcode medication administration technology on how nurses spend their time providing patient care. Poon E, Keohane C, Bane A, Featherstone E, Hays B, Dervan A, Woolf S, Hayes J, Newmark L, Gandhi T. *Journal of Nursing Administration: December 2008 - Volume 38 - Issue 12 - pp 541-549*
- Nurses attitudes toward the use of the bar-coding medication administration system. Marini S, Hasman A, Huijter H, Dimassi H. *CIN: Computers, Informatics, Nursing: March/April 2010-Volume 28 - Issue 2 - pp 112-123*
- "Nurses Don't Hate Change": Survey of nurses in a neonatal intensive care unit regarding the implementation, use and effectiveness of a bar code medication administration system (<http://www.longwoods.com/content/20981>)

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**General Inpatient Units**

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- Effect of bar-code technology on the safety of medication administration (<http://www.nejm.org/doi/pdf/10.1056/NEJMsa0907115>)
- Using a bar-coded medication administration system to prevent medication errors in a community hospital network (<http://www.ajhp.org/content/62/24/2619.full.pdf+html>)
- Using bar-code technology and medication observation methodology for safer medication administration (<http://www.ajhp.org/content/64/5/536.full.pdf+html>)

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**Critical Care Units**

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- Effect of bar-code-assisted medication administration on medication administration errors and accuracy in multiple patient care areas (<http://www.ajhp.org/content/66/13/1202.full.pdf+html>)
- Effect of bar-code-assisted medication administration on medication error rates in an adult medical intensive care unit (<http://www.ajhp.org/content/66/12/1110.full.pdf+html>)
- Effectiveness of a Barcode Medication Administration System in Reducing Preventable Adverse Drug Events in a Neonatal Intensive Care Unit: A Prospective Cohort Study. Morriss F, Abramowitz P, Nelson S, Milavetz G, Michael S, Gordon S, Pendergast J, Cook EF. *The Journal of Pediatrics.* Volume 154, Issue 3 , Pages 363-368.e1, March 2009
- Risk of adverse drug events in neonates treated with opioids and the effect of a bar-code-assisted medication administration system (<http://www.ajhp.org/content/68/1/57.full.pdf+html>)

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**Overcoming Barriers**

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- Bar Code Medication Administration Technology: Characterization of High-Alert Medication Triggers and Clinical Workarounds (<http://www.annals.org/content/144/7/510.full.pdf+html>)
- Computerization Can Create Safety Hazards: A Bar-Coding Near Miss (<http://www.ajhp.org/content/63/15/1442.full.pdf+html>)
- Improving the bar-coded medication administration system at the Department of Veterans Affairs
- Methodologies for sustaining barcode medication administration compliance: a multi-disciplinary approach. Miller D, Fortier C, Garrison K. *Ann Pharmacother* February 2011 vol. 45 no. 2 162-168
- Overcoming barriers to the implementation of a pharmacy bar code scanning system for medication dispensing: A case study (<http://jamia.bmj.com/content/16/5/645.full.pdf>)
- Workarounds to Barcode Medication Administration Systems: Their Occurrences, Causes, and Threats to Patient Safety (<http://jamia.bmj.com/content/15/4/408.full.pdf+html>)



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**Miscellaneous**

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- Bar-code medication administration system for anesthetics: Effects on documentation and billing (<http://www.ajhp.org/content/65/7/655.full.pdf+html>)
  - Errors Prevented by and Associated with Bar-Code Medication Administration Systems. Cochran GL, Jones KJ, Brockman J, Skinner A, Hicks RW. *Jt Comm J Qual Patient Saf.* 2007 May;33(5):293-301, 245.
  - Practical guide to bar coding for patient medication safety (<http://www.ajhp.org/content/60/8/768.full.pdf+html>)
  - Quality-monitoring program for bar-code-assisted medication administration (<http://www.ajhp.org/content/66/12/1125.full.pdf+html>)
  - Scanning for safety: An integrated approach to improved bar-code medication administration. Early C, Riha C, Martin J, Lowdon K, Harvey E. *CIN: Computers, Informatics, Nursing:* March 2011 - Volume 29 - Issue 3 - pp 157-164
  - Scanning for safety: An integrated approach to improved bar-code medication administration. Early C, Riha C, Martin J, Lowdon K, Harvey E. *CIN: Computers, Informatics, Nursing:* March 2011 - Volume 29 - Issue 3 - pp 157-164
  - Severity of medication administration errors detected by a bar-code medication administration system (<http://www.ajhp.org/content/65/17/1661.full.pdf+html>)
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### ***Projects***

The student should complete at least one longitudinal informatics project. Preceptor and student should choose a project during the second week of rotation (see example projects listed below). Some projects listed may be more appropriate for students on extended-length (e.g., several months in length) rotations, which should be considered when determining project(s) to be completed. Student should present findings / deliverables to the appropriate audience during the rotation.

#### Potential Projects

1. Complete a specific section of the ISMP Hospital self assessment for the organization. Alternatively, for organizations that complete the assessment yearly, perform a gap analysis based on the most recently completed assessment. Choose 1 or 2 items and develop a plan to achieve the goal.
2. Complete ISMP Medication Safety Self Assessment for Automated Dispensing for the organization. Alternatively, for organizations that complete the assessment yearly, perform a gap analysis based on the most recently completed assessment. Choose 1 or 2 items and develop a plan to achieve the goal.
3. Complete ISMP Medication Safety Self Assessment for Bedside Barcoding Readiness. Alternatively, for organizations that complete the assessment yearly, perform a gap analysis based on the most recently completed assessment. Choose 1 or 2 items and develop a plan to achieve the goal.
4. Interview a potential vendor on a new technology
5. Conduct an evaluation of an Integrated Computerized Pharmacist Intervention Database
6. Constructing project plans for new system implementation
7. Review override reports on two nursing units and make recommendations as to appropriate over-ridable medications.
8. Describe the flow of orders within the pharmacy and indicate points of potential failure and how technology can enhance patient safety. Observe the workflow of central and decentralized pharmacy operations with regard to technology and informatics, and demonstrate proficiency in dispensing medications safely.
9. Demonstrate how to optimize drug storage and usage in automated dispensing cabinets. Perform a cabinet optimization project on at least two different nursing units.

10. Design and implement pilot interventions to change problematic or potentially problematic aspects of the medication-use system with the objective of improving quality.
11. Assist preceptor in development of a pharmacy informatics webinar/podcast with ASHP.
12. Write a summary analysis differentiating “quality” from “safety” to give student a baseline understanding of the key differences between both these concepts/areas of practice.
13. Represent pharmacy informatics concerns in strategic planning for the implementation, use, and maintenance of technology and automation systems.
14. Assist with the development of a business case related to informatics initiatives
15. Identify opportunities for improvement in the organization’s medication-use system by comparing the medication-use system to relevant best practices.
16. Describe and demonstrate the process for doing a compliance audit of patient’s medication charges.
17. Be able to identify a potential gap in patient safety.
18. Assist with designing a yearly pharmacist competency assessment
19. Create and administer a survey to nurses, pharmacists and/or physicians on IT-user satisfaction
20. Evaluate an Integrated Computerized Pharmacist Intervention Database
21. Determine strategies to minimize “alert fatigue” in a pharmacy computer system
22. Assess, design, test and implement a solution for any other informatics issue you’ve seen or heard about that you feel needs to be addressed
23. Assess and help design mobile apps in healthcare, business intelligence applications for pharmacy leaders, and risk management consideration surrounding the electronic medical record
24. Review and analyze reports from the pharmacy system or EHR on medication ordering practices and suggest strategies for improvement

### ***Evaluation***

- The preceptor will evaluate the student on achievement of the predefined goals and objectives for the rotation. Students will also be asked for any specific personal goals for the rotation.
- Students will also be evaluated on their interactions with pharmacists and pharmacy technicians within the organization’s pharmacy, as well as daily discussions with the preceptor concerning reported pharmacy information, automated technology and discussion topics.
- The evaluation will include an oral mid-point evaluation to assess progress. The preceptor and student will complete a final written evaluation at the conclusion of the rotation according to school of pharmacy criteria.

### ***Acknowledgements***

This current Informatics Student Rotation Tool was developed by the Section of Inpatient Care Practitioners (SICP) – Advisory Group on Pharmacy Practice Experiences (SAG-PPE) members in 2012, following a request from 2011-2012 SICP-Chair Jennifer Edwards. The work was completed by the 2011-2012 SAG chair, Rony Zeenny and SAG-members Lori Ann Prater and Aaron Burton.

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The tool content was mainly adapted from the Section of Pharmacy Informatics and Technology (SOPIT) resources. The tool was then reviewed for content inclusion by 2011-2012 SOPIT-SAG on Pharmacy Informatics Education members with the assistance of SOPIT Director Karl Gumpfer.

## Website Resources

<b>Agency for Healthcare Research and Quality: Health, Information and Technology</b>	<a href="http://www.healthit.ahrq.gov">www.healthit.ahrq.gov</a>
<b>Agency for Healthcare Research and Quality: Health, Information and Technology</b>	<a href="http://www.healthit.ahrq.gov">www.healthit.ahrq.gov</a>
Automated Medication Dispensing Devices	<a href="http://www.ahrq.gov/clinic/ptsafety/chap11.htm">www.ahrq.gov/clinic/ptsafety/chap11.htm</a>
Computerized Physician Order Entry (CPOE) with Clinical Decision Support Systems (CDSSs)	<a href="http://www.ahrq.gov/clinic/ptsafety/chap6.htm">www.ahrq.gov/clinic/ptsafety/chap6.htm</a>
Tools and Strategies for Quality Improvement and Patient Safety	<a href="http://www.ahrq.gov/qual/nursesbdbk/docs/HughesR_QMBMP.pdf">www.ahrq.gov/qual/nursesbdbk/docs/HughesR_QMBMP.pdf</a>
<b>American Society of Health-Systems Pharmacists</b>	<a href="http://www.ashp.org">www.ashp.org</a>
ASHP Statement on Bar-Code Enabled Medication Administration	<a href="http://www.ashp.org/DocLibrary/BestPractices/AutoITStBCMA.aspx">www.ashp.org/DocLibrary/BestPractices/AutoITStBCMA.aspx</a>
ASHP Statement on Bar-Code Verification During Inventory, Preparation, and Dispensing of Medications	<a href="http://www.ashp.org/DocLibrary/BestPractices/AutoITStBCVerif.aspx">www.ashp.org/DocLibrary/BestPractices/AutoITStBCVerif.aspx</a>
ASHP: Section of Pharmacy Informatics and Technology: Resources	<a href="http://www.ashp.org/Import/MEMBERCENTER/Sections/SectionofPharmacyInformaticsandTechnology/CareerDevelop/ResidenciesRotations.aspx">www.ashp.org/Import/MEMBERCENTER/Sections/SectionofPharmacyInformaticsandTechnology/CareerDevelop/ResidenciesRotations.aspx</a>
ASHP: What is Pharmacy Informatics	<a href="http://www.ashpmedia.org/webinar/SOPIT/2010-08-2316_21SOPIT.wmv">www.ashpmedia.org/webinar/SOPIT/2010-08-2316_21SOPIT.wmv</a>
General Principles for Purchase and Safe Use of Computerized Prescriber Order Entry Systems	<a href="http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/General-Principles-for-Computerized-Prescriber.aspx">www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/General-Principles-for-Computerized-Prescriber.aspx</a>
Landmines and Pitfalls of Computerized Prescriber Order Entry	<a href="http://www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/Landmines-and-Pitfalls.aspx">www.ashp.org/menu/PracticePolicy/ResourceCenters/PatientSafety/Landmines-and-Pitfalls.aspx</a>
<b>American Medical Informatics Association (AMIA)</b>	<a href="http://www.amia.org/node/2081">www.amia.org/node/2081</a>
<b>Certification Commission For Healthcare Information Technology (CCHIT)</b>	<a href="http://www.cchit.org">www.cchit.org</a>
<b>Institute For Safe Medication Practices</b>	<a href="http://www.ismp.org">www.ismp.org</a>
Institute for Safe Medication Practices (ISMP): Effective Approaches to Standardization and Implementation of Smart Pump Technology	<a href="http://www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf">www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf</a>
Overview of Safety Recommendations for Medication Management Technology	<a href="http://www.ismp.org/CE/medmanagementtech/Default.asp">www.ismp.org/CE/medmanagementtech/Default.asp</a>
Smart Pump technology	<a href="http://www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf">www.ismp.org/profdevelopment/SmartPumpTechnologyforwebce.pdf</a>
<b>Healthcare Information and Management Systems Society (HIMSS)</b>	<a href="http://www.himss.org/ASP/topics_pharmacyInformatics.asp">www.himss.org/ASP/topics_pharmacyInformatics.asp</a>
<b>Health Level Seven International</b>	<a href="http://www.hl7.org">www.hl7.org</a>
<b>U.S. Food and Drug Administration</b>	<a href="http://www.fda.gov">www.fda.gov</a>
Infusion Pump Improvement Initiative	<a href="http://www.fda.gov/downloads/MedicalDevices/ProductsandMedicalProcedures/GeneralHospitalDevicesandSupplies/InfusionPumps/UCM206189.pdf">http://www.fda.gov/downloads/MedicalDevices/ProductsandMedicalProcedures/GeneralHospitalDevicesandSupplies/InfusionPumps/UCM206189.pdf</a>
<b>Miscellaneous References</b>	
Patient Safety Authorities – Commonwealth of Pennsylvania: Smart Infusion Pump Technology: Don't Bypass the Safety Catches	<a href="http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2007/dec4(4)/Documents/dec;4(4).pdf">http://patientsafetyauthority.org/ADVISORIES/AdvisoryLibrary/2007/dec4(4)/Documents/dec;4(4).pdf</a>

## Pharmacy Informatics Rotation: Orientation Checklist

(Adapted from Sylvia Thomley, Pharm.D., M.S. – Director IT Clinical Informatics – Sanford Health)

1. Name of the Individual you are interviewing:

\_\_\_\_\_

2. List the technologies that this person manages

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

3. Pick one of the technologies.

a. What is the purpose of this technology? What activities is it used for?

\_\_\_\_\_

b. Who is the vendor?

\_\_\_\_\_

c. What is the relationship with the vendor?

\_\_\_\_\_

d. What hardware is used? Any specific configuration needed?

\_\_\_\_\_

e. What tasks get done in maintaining the system? How frequently are the tasks done? (Daily vs. weekly vs. monthly vs. semi-annually vs. annually)?

\_\_\_\_\_

\_\_\_\_\_

f. What is the role of the following individuals in the *management* or *use* of the technology?

Staff	Management Roles	User Roles
Pharmacists		
Technicians		
Managers		
Non-Pharmacy Staff (nurses, RT, etc)		
Patients		
IT		