

REQUIRED COMPETENCY AREAS, GOALS, AND OBJECTIVES FOR POSTGRADUATE YEAR TWO (PGY2) PHARMACY INFORMATICS RESIDENCIES

Prepared in collaboration with the ASHP Section of Pharmacy Informatics and Technology

Introduction

The PGY2 Residency in Pharmacy Informatics draws upon the clinical foundation of entering residents, including general competencies for managing medication-use processes and support of optimal medication therapy outcomes. The residency trains individuals who can lead the evolution of organizations' medication-use processes by applying Pharmacy Informatics principles, standards, and best practices. Graduates are adept in the language and concepts of information technology, equipping them to function in an interprofessional environment.

The residency inculcates the capacity to identify where knowledge management, information technology and automation can improve the medication-use process. Graduates are prepared to be leaders who will advocate the Pharmacy Informatics' perspective. Graduates exit with the capacity to contribute pharmacy leadership to project management of significant information technology and automation initiatives. Such projects may include, but are not limited to, creation of clinical decision support, ensuring accuracy of medication order intent, guiding clinicians to appropriate medication use, and also the selection, acquisition, implementation and evaluation of information technology and automation that support pharmacy operations and the medication-use process.

PGY2 Pharmacy Informatics Residency graduates are prepared to enter practice positions in a variety of environments. They are equipped to be the pharmacy department's source of informatics knowledge, skills, and abilities needed to serve health system information technology, automation and data management needs. In the case of large health systems, graduates are prepared to assume roles in sub-specialties of Pharmacy Informatics. The scope of PGY2 Pharmacy Informatics training also enables graduates to participate in broader healthcare informatics initiatives or design innovative information technology and informatics solutions for healthcare.

The competency areas, goals, and objectives are for use with the *ASHP Accreditation Standard for Postgraduate Year Two (PGY2) Pharmacy Residency Programs*. The first seven competency areas described herein are required, and the others are elective.

The required competency areas and all of the goals and objectives they encompass must be included in all programs. Programs may add one or more additional competency areas. Programs selecting an additional competency area are not required to include all of the goals and objectives in that competency area. In addition to the potential additional competency areas described in this document, programs are free to create their own additional competency areas with associated goals and objectives. Each of the goals encompassed by the program's selected program competency areas (required and additional) must be evaluated at least once during the residency year. In addition, elective competency areas may be selected for specific residents only.

Each of the objectives listed in this document has been classified according to educational taxonomy (cognitive, affective, or psychomotor) and level of learning. An explanation of the taxonomies is available elsewhere.¹

Competency areas for PGY1 residencies are available on the ASHP website. PGY2 competency areas, goals, and objectives in informatics residencies are differentiated from those from PGY1 by breadth and depth and the expectation of PGY2 residents for greater work competence and proficiency.

Definitions

Competency Areas: Categories of the residency graduates' capabilities. Competency areas are classified into three categories:

¹Anderson, L. W. and Krathwohl, D. R., et al (Eds.) (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Allyn & Bacon. Boston, MA (Pearson Education Group).

- 1) *Required*: Seven competency areas are required (all programs must include them and all their associated goals and objectives).
- 2) *Additional (for program)*: Competency area(s) that residency programs may choose to use (in addition to the seven required areas) to meet program-specific program needs.
- 3) *Elective (for specific residents)*: Competency area(s) selected optionally for specific resident(s).

Educational Goals (Goal): Broad statement of abilities.

Educational Objectives: Observable, measurable statements describing what residents will be able to do as a result of participating in the residency program.

Criteria: Examples that describe competent performance of educational objectives. They are intended to be used to give feedback to residents on the how well they are doing and how they can improve on the skill described in educational objectives while they engage in an activity.

Activities: The Standard requires that learning activities be specified for each educational objective in learning experience descriptions. Activities are what residents will do to learn and practice the skills described in objectives. Activities are the answer to the question “What can residents do in the context of this learning experience that will provide the kind of experiences necessary to achieve the educational objective?” (Compare and contrast activities with criteria by referring to the definition of criteria immediately above.) Specified activities should match the Bloom’s Taxonomy learning level stated in parentheses before each objective.

Example:

Objective R2.1.2: (Applying) Execute tasks required to maintain a technology or automation system.

Learning activity: Perform specific system maintenance regularly and accurately working within the designated group.

Criteria:

- Perform maintenance task(s) according to an established schedule.
- Identify opportunities for adding a maintenance task to achieve optimal performance of a technology or automation system.
- Collaborate with other IT teams or vendors as needed to perform maintenance tasks.

Competency Area R1: Informatics Fundamentals: Standards and Best Practices

Goal R1.1: Demonstrate understanding of basic pharmacy informatics principles, standards, and best practices.

Objective R1.1.1: (Understanding) Identify standards and standard-setting bodies governing the use of data, information and knowledge in healthcare.

Criteria:

- Identify standards and key external governing bodies that influence implementation and ongoing management of information systems in healthcare.

Objective R1.1.2: (Understanding) Identify influences for best practices in pharmacy informatics.

Criteria:

- Discuss the *ASHP Statement on the Pharmacist’s Role in Clinical Informatics*.
- Discuss the *ASHP Statement on the Pharmacy Technician’s Role in Pharmacy Informatics*.
- Identify resources for directing best practices in pharmacy informatics.

Goal R1.2: Evaluate opportunities for improving patient outcomes, clinical and operational efficiencies, safety and quality of the medication-use process through the application of Continuous Quality Improvement (CQI) strategies.

Objective R1.2.1: (Understanding) Demonstrate knowledge of the formal structure of a CQI initiative.

Criteria:

- Identify the basic components of a CQI initiative (Plan-Do-Study-Act).
- Articulate the purpose of each step of the PDSA cycle.

- Review the Institute for Healthcare Improvement (IHI) Model.

Objective R1.2.2: (Evaluating) Skillfully use data collection tools to identify opportunities to improve medication-use processes.

Criteria:

- Demonstrate understanding of the process of direct observation of the human/technology interface for the purpose of analysis.
- Effectively use interviewing skills for the purpose of understanding the human/technology interface.
- Recognize and articulate limitations of identification techniques.
- Utilize subjective direct observation, survey and interview techniques.
- Incorporate objective data collection techniques to confirm subjective root cause analysis.
- Tools may include, but are not limited to, fish bones, Five Whys, Pareto, 80/20 rule, other reports, root cause analysis.

Objective R1.2.3: (Applying) Participate in a CQI initiative for a component of a technology or automation system.

Criteria:

- Organize an appropriate team to evaluate a technology or automation system and identify areas for improvement.
- Identify a specific aim for the CQI initiative .
- Establish outcome measures for the CQI initiative.
- Agree on changes that will address the aim of the CQI initiative.
- Test changes.
- Implement changes.
- Evaluate results.

Goal R1.3: Assure the interoperability and integration of health information systems.

Objective R1.3.1: (Understanding) Identify the levels of health information systems interoperability.

Criteria:

- Cite examples of the three levels of interoperability: Foundational, Structural, and Semantic.
- Distinguish the unique purpose of each type of interoperability.
- Identify current efforts around Health Information Exchange (HIE), and current examples of interoperability outside of the health system.

Objective R1.3.2: (Understanding) Describe what is meant by integration of health information technology.

Criteria:

- Identify the advantages and challenges related to integration of clinical systems.
- Explain the difference between an integrated and interfaced technology or automation system.

Objective R1.3.3: (Analyzing) Evaluate the properties of an interface message for a technology or automation system to allow for efficient troubleshooting.

Criteria:

- Perform a search of interface messages to investigate a specific issue.
- Dissect an interface message to find targeted information.

Objective R1.3.4: (Analyzing) Conduct interface testing for a representative technology or automation system.

Criteria:

- Review and analyze an existing or new interface testing plan, and add any scenarios pertinent for testing.
- Execute interface testing in collaboration with other IT teams and/or a vendor contact.
- Troubleshoot errors identified in interface testing and collaborate with other IT teams and/or a vendor contact to resolve.

Goal R1.4: Ensure security of data stored in health information systems.

Objective R1.4.1: (Applying) Implement measures to ensure data security in the context of supporting, maintaining and/or implementing technology and automation systems.

Criteria:

- Articulate the organization's and regulatory policies for security of patient information.

- Articulate ethical considerations related to management of protected health information.
- Identify specific steps to guard patient data.
- Apply accepted criteria for system security during assessments.
- Understand current HIPAA regulations and the application of those regulations to technology and automation systems.
- Understand various risks and security issues with regard to all potential vectors, for example, email, external software systems, electronic health records.
- Articulate the following data issues: De-identification, encryption, HIPAA, PHI, understanding proper approvals.

Goal R1.5: Manage downtime associated with health information systems.

Objective R1.5.1: (Understanding) Describe downtime processes and how they relate to an outage of a health information system.

Criteria:

- Identify the drivers for tolerance, e.g., strategies for recovery, criticality of the system, outage window.
- Differentiate between planned versus unplanned downtimes.

Objective R1.5.2: (Understanding) Describe the relationship of service level agreements in the context of system outages, including expectations set for vendors.

Criteria:

- Discuss process for establishing expected service level agreements.
- Articulate importance of documenting service level agreements.
- Identify the connection of service level agreements with contract terms.
- Understand repercussions if service level agreement is not met.
- Understand organizational structure for service level agreements.

Objective R1.5.3: (Evaluating) Assess Pharmacy’s Business Continuity Plan for a system outage.

Criteria:

- Identify policy that articulates downtime procedures, including planned versus unplanned.
- Review contents of a “downtime box”, or other resources to support manual processes.
- Establish staff knowledge on reacting to a downtime situation (e.g., downtime drills, training, communication plan, issue escalation processes).
- Propose opportunities to strengthen a department’s readiness for a downtime scenario.
- Assess the process for recovery from downtime and access restoration.

Competency Area R2: Information Technology and Automation

Goal R2.1: Maintain and support technology or automation systems.

Objective R2.1.1: (Creating) Configure medication records according to established convention.

Criteria:

- Participate in loading clinical content updates, rules, reports, and medication information from vendors and conducting quality assurance checks on the updates.
- Participate in formulary additions and upgrades to medication related technology and automation systems, including, but not limited to:
 - Formulary additions/deletions
 - Order Sets
 - Third party database medication loading
 - Cost maintenance and revenue cycle
 - Ancillary systems

Objective R2.1.2: (Applying) Execute tasks required to maintain a technology or automation system.

Criteria:

- Perform maintenance task(s) according to an established schedule.
- Identify opportunities for adding a maintenance task to achieve optimal performance of a technology or automation system.
- Collaborate with other IT teams or vendors as needed to perform maintenance tasks.

Objective R2.1.3: (Creating) Support end users' reporting issues with a technology or automation system.

Criteria:

- Adhere to expected turn-around time for incident resolution according to any service level agreement.
- Effectively troubleshoot and devise a plan to address a reported incident, consulting with other teams/members as necessary.

Goal R2.2: Demonstrate a working knowledge of technology and automation systems for prescribing medications.

Objective R2.2.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for prescribing medications.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for prescribing medications.

Objective R2.2.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for prescribing medications.

Goal R2.3: Demonstrate a working knowledge of technology and automation for order processing and verification.

Objective R2.3.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for order processing and verification.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for order processing and verification.

Objective R2.3.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for order processing and verification.

Goal R2.4: Demonstrate a working knowledge of technology and automation for the safe and efficient preparation, distribution, and dispensing of medications.

Objective R2.4.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for the preparation, distribution and dispensing of medications.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for the distributing and dispensing of medications.

Objective R2.4.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for the preparation, distribution and dispensing of medications.

Goal R2.5: Demonstrate a working knowledge of technology and automation for safe and accurate medication administration and documentation.

Objective R2.5.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for medication administration and documentation.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for medication administration and documentation.
- Explain the benefits of and challenges to the positive identification of the medication and the patient during medication administration and documentation.
- Explain the seven rights of medication administration and documentation.
- Explain the function of point-of-care decision support systems.

Objective R2.5.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for administering medication and documentation.

Goal R2.6: Demonstrate a working knowledge of surveillance systems for clinical monitoring.

Objective R2.6.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for clinical monitoring.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for clinical monitoring and surveillance.
- Describe the relevance of synchronous versus asynchronous decision support.
- Explain patient-specific versus population-specific surveillance.
- Explain the impact of surveillance systems on clinical pharmacy practice.
- Explain the components of a surveillance system.

Objective R2.6.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for clinical monitoring.

Goal R2.7: Demonstrate a working knowledge of technology and automation solutions for managing pharmacy inventory.

Objective R2.7.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for pharmacy inventory management.

Criteria:

- Explain current technologies available to manage pharmacy inventory, e.g., centralized, de-centralized, RFID, robotics, automation.

Objective R2.7.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems for pharmacy inventory management.

Goal R2.8: Demonstrate a working knowledge of technology and automation systems that assist with transitions of care.

Objective R2.8.1: (Understanding) Explain critical factors for assessing the functions, benefits, and constraints relative to safety and effectiveness of available technology and automation systems for transitions of care.

Criteria:

- Explain current literature with regard to patient safety related to technology and automation systems for transitions of care.

Objective R2.8.2: (Analyzing) Make optimization recommendations to and/or perform requisite build in available technology and automation systems that assist with transitions of care.

Goal R2.9: Demonstrate working knowledge of unique needs of stakeholders in various technology or automation systems in diverse practice settings and how are those areas supported by informatics.

Objective R2.9.1: (Understanding) Explain critical factors in the unique area(s) and how they may impact informatics.

Criteria:

- Explain informatics needs in diverse practice settings that may include, but are not limited to, medication therapy management, specialty pharmacy, ambulatory care, operating room, labor and delivery, oncology, etc.

Goal R2.10: Demonstrate a working knowledge of emerging technology and automation systems that assist with the medication-use process.

Objective R2.10.1: (Understanding) Describe best practices to identify and evaluate emerging technology and automation systems associated with medication-use.

Competency Area R3: Clinical Decision Support

Goal R3.1: Analyze Clinical Decision Support (CDS) to ensure support of effective medication-related decisions and ensure it is available in a useful format to members of interprofessional teams. (Problem Analysis)

Objective R3.1.1: (Understanding) Describe components of effective CDS and understand options available to achieve desired result.

Criteria

- Define Human-Factors Engineering, Human-Computer Interface, Graphical-User Interface, input and output factors.

- Describe the principles of User Interface Design, Display Design, and Iterative Design.
- Describe advantages and disadvantages of tools available for CDS within pharmacy technology and the electronic health record.
- Compare and contrast different options available for clinical surveillance.
- Explain the role of passive and active CDS.
- Explain the difference between synchronous and asynchronous CDS.
- Explain the role of standardized vocabularies and taxonomies in the implementation of effective CDS.
- Discuss open-source information used in the development of CDS.
- Review drug alert editorial policies from a drug alert database vendor.
- Describe the classification structure for drug alerts in your EHR or Pharmacy System.
- Describe information routinely added locally that is not supplied by the database vendor related to safe medication practices (hyperlinks to facility guidelines, customization to the organization).
- Describe considerations for CDS for pharmacogenomics and other specialty areas.

Objective R.3.1.2: (Analyzing) Assure that information required to support effective medication-related decisions is available in a useful format to members of interdisciplinary teams.

Criteria:

- Explain the level of specificity that is required when diagramming clinical decision-making for technical versus clinical audiences.
- Exercise skill in diagramming an interprofessional workflow and evaluate the need for CDS to improve safety, quality, and efficiency.
- Interact with interprofessional team members involved with the medication-use process and make recommendations for CDS enhancements or modifications, new CDS, or possible CDS removal.
- Deconstruct an existing CDS rule and discuss key elements.
- Present a journal club highlighting an interprofessional CDS tool.
- Participate on a CDS Committee.
- Prepare or update training materials for a CDS.
- Review externally reported quality metrics to identify areas for possible CDS implementation.
- Discuss sources and limitations of non-discrete data in the medication-use process.

Goal R3.2: Evaluate the usefulness/effectiveness of CDS.

Objective 3.2.1: (Evaluating) Validate the effectiveness of an existing CDS tool.

Criteria:

- Participate in CDS maintenance and evaluation processes.
- Evaluate a report to assess the effectiveness of an existing CDS tool.
- Use appropriate methods for evaluating validity of data, information, and knowledge in information systems, automation, and technology.
- Apply continuous quality and performance improvement methods.
- Perform a gap analysis of recognized standards or best practices with automation or CDS to determine if enhancements are needed.
- Identify opportunities for improvement in the selection of sources of data, information, and knowledge so as to enhance the validity of the database.

Goal R3.3: Create and maintain decision support that allows for efficient and appropriate monitoring of patients by members of interdisciplinary, patient-centered teams, particularly pharmacists.

Objective 3.3.1: (Creating) Create CDS using appropriate information, in the right channel, to the right person, in the right format and the right time in the workflow.

Criteria:

- Write a proposal to recommend a new CDS tool and present to a team.
- Build, test, and implement a new CDS to achieve a specific outcome.
- Identify an existing CDS tool that is not optimized to the 5 rights of CDS and recommend an enhancement.
- Work with clinicians to optimize presentation of relevant information in the appropriate place in workflow.

Competency Area 4: Data Analytics

Goal R4.1: Learn the fundamental concepts of data analytics and data driven patient care.

Objective R4.1.1: (Understanding) Comprehend the sources of data and the development of data models.

Objective R4.1.2: (Understanding) Describe the different types of data analytics.

Criteria:

- Describe the uses and differences between the different types of data analytics, e.g., descriptive, big data analytics, predictive, prescriptive, etc.
- Define the Learning Healthcare System and precision medicine.
- Explain the role of data analytics in population health initiatives and management.
- Define machine learning and the differences between supervised and unsupervised learning.

Objective R4.1.3: (Understanding) Explain the concept of data warehousing and its uses in clinical and operational decision-making.

Goal R4.2: Participate throughout the entire life cycle of report creation.

Objective R4.2.1: (Evaluating) Identify, interpret, and translate report requests and needs.

Criteria:

- Determine preliminary rationale of a report and appropriate data fields.
- Gain user feedback for clarity.

Objective R4.2.2: (Creating) Use database skills and available analytical tools to successfully extract, construct, and utilize reports.

Criteria:

- Extract data from databases using available reporting software and/or Structured Query Language (SQL).
- Merge data from multiple data sources together.
- Produce import and export data sets.

Objective R4.2.3: (Evaluating) Effectively validate the accuracy and quality of data and be able to resolve discrepancies.

Criteria:

- Gain user feedback to determine if needs are met.

Objective R4.2.4: (Applying) Publish/deliver finalized reports and data requests.

Criteria:

- Publish final report and notifies appropriate team members.
- Present output of report to appropriate team members.
- Expertly respond to questions regarding the data output.

Objective R4.2.5: (Creating) Provide effective analysis and communication and/or presentation of results

Criteria:

- Application of the information value chain.
- Able to use styling and effective data visualization.

Competency Area R5: Project Management

Goal R5.1.1: Demonstrate ability to effectively plan and conduct an informatics project.

Description: Ideally, goals and objectives will be addressed through residents working on one project. However, if this is not possible, all objectives must be addressed by the end of the residency year and may be covered through work on more than one initiative.

Objective R5.1.1: (Understanding) Demonstrate understanding of informatics quality improvement or research projects, business agility and other project management methodologies commonly used in the information technology industry.

Criteria:

- Understand general project management principles (Agile, Lean, Six Sigma, etc.) and stages, including conception and initiation, planning, execution, performance/monitoring, and project close.
- Understand project management processes unique to informatics, e.g., vendor selection, testing, training, downtime, and risk mitigation strategies.

- Understand the importance of data generated by health information technology or automated systems and its use in project management.
- Discuss other knowledge areas that may influence a project's success, e.g., integration, quality, HR, communication, risk, procurement, stakeholders.
- Discuss the difference between projects and operations.
- Understand components of an informatics project plan, explain its highlights including the statement of resources, Gantt charts, and linked project steps.

Objective R5.1.2: (Analyzing) Identify an informatics project related to medication management technology or automation initiatives. (Conception)

Criteria:

- Determine an appropriate practice-related project of significance to medication management technology or automation initiatives.
- Assist in determination of budget requirements for the project.
- Appropriately identify problems and opportunities for improvement and analyze relevant background data, including Triple Constraints (Time/Cost/Scope).
- Accurately evaluate or assist in evaluation of data generated by health information technology or automated systems.
- Understand the organization's project approval process.

Objective R5.1.3: (Understanding) Describe the vendor selection process for a technology or automation system. (Planning)

Criteria:

- Understand the importance of writing clear project requirements.
- Discuss circumstances when an RFP versus RFI should be utilized.
- Explain the categories of information and formatting in each.
- Explain the importance of writing clear directions for vendor responses.
- Explain the importance of designing an objective strategy for evaluating vendor responses.
- Explain the use of key values for ranking vendors.
- Understand importance of involving stakeholders in decision process.
- Explain the characteristics of safe and effective utilization of technology or automation systems in the medication-use process.
- Describe typical criteria for software functionality.
- Explain typical criteria for financial analysis of an RFP.
- Explain typical criteria for technical requirements.

Objective R5.1.4: (Evaluating) Contribute to the development of a plan for the evaluation of a new or existing medication management technology or automation system. (Planning)

Criteria:

- Assist in development of a plan for the evaluation of a technology or automation system, e.g., on-site demonstrations, site visits, stakeholder involvement and structured evaluation processes.
- Assist in development of metrics for evaluation of a technology or automation system.

Objective R5.1.5: (Creating) Develop a project plan for the approved medication management technology or automation system project with project requirements and timeline. (Planning)

Criteria:

- Steps in plan are well defined with clear project requirements and timeline.
- Apply safety design practices (e.g., standardization, simplification, human factors training, lean principles, FOCUS-PDCA, other process improvement or research methodologies) appropriately and accurately.
- Identify stakeholders affected by the project, and assemble appropriate workgroups or project teams.
- Explain how data flow and workflow process diagrams can contribute to the identification of stakeholders.
- Develop workflow process diagram(s) for the project.
- Plan for improvement includes appropriate reviews and approvals required by departments or organization and addresses concerns of all stakeholders.

- Apply evidence-based principles, if applicable.
- Develop a plan that can be realistically completed in the desired time frame.
- Develop a feasible design for a project that considers who or what will be affected by the project.
- Identify and obtain necessary approvals and training, (e.g., IRB, HIPAA, funding, staff training) for a practice-related project.
- Establish scope change management processes.

Objective R5.1.6: (Evaluating) Devise plans for the efficient and effective utilization of human and material resources relative to pharmacy informatics projects. (Planning)

Criteria:

- Understand the importance of placing value on the contribution of all individuals involved in a technology or automation system project.
- Evaluate effectiveness of project planning with regard to managing human and material resources.
- Evaluate a variety of issues to consider when planning utilization of human and material resources for technology and automation projects.
- Identify appropriate communication channels for teams.

Objective R5.1.7: (Evaluating) Collect and evaluate data for the project. (Planning)

Criteria:

- Collect the appropriate types of data as required by project design.
- Use appropriate electronic data and information from internal information databases, external online databases, appropriate Internet resources, and other sources of decision support, as applicable.
- Use appropriate methods for analyzing data.
- Identify need for additional modifications or changes to the project plan.
- Accurately assess the impact of the project, including its sustainability, using operational, clinical, economic, and/or humanistic outcomes of patient care.
- Use continuous quality improvement (CQI) principles to assess the success of the implemented change, if applicable.
- Consider the impact of the limitations of the project or research design on the interpretation of results.

Goal R5.2: Participate in contingency planning for an implementation of a medication management technology or automation system (Planning).

Objective R5.2.1: (Analysis) Using skill with risk analysis procedures, identify parameters for a contingency plan.

Criteria:

- Participate in a proactive risk analysis and/or Failure Modes and Effects Analysis (FMEA).
- Understand different types of risk involved with technology and automation systems.
- Understand importance of support plans and communication during implementation.

Objective R5.2.2: (Evaluating) Contribute to the development of a contingency plan for the targeted technology or automation system. (Planning)

Criteria:

- Explain the components of a contingency plan.
- Explain the importance of including workarounds and interim bridge solutions during downtime and implementation in contingency planning.
- Develop a risk mitigation plan for the implementation of the new technology or automation system.
- Identify possible barriers in execution and potential adjustments to accommodate.
- Develop downtime procedures for the new system.

Goal R5.3: Contribute to the development of a plan for testing a technology or automation system.

Objective 5.3.1: (Understanding) Explain concepts regarding testing of technology or automation systems.

Criteria:

- Explain the concept of technology or automation testing.
- Explain the components of a testing plan for a technology or automation system, including the following:
 - interface testing

- testing for the validity of data
 - unit testing
 - integration testing
 - functional testing
 - testing for clinical validity
 - regression testing
 - usability testing
 - end user testing
- Explain the value of release notes for technology or automation upgrades.
- Explain the necessity of balancing decisions for what to include in the testing plan relative to available resources.

Objective R5.3.2: (Creating) Develop and participate in testing of a technology or automation system.

Goal R5.4: Implement the project, technology or automation system, or supplemental upgrades or build outs. (Project Execution)

Objective R5.4.1: (Applying) Demonstrate skills of project implementation.

Criteria:

- Follow established timeline and milestones.
- Ensure thorough testing is completed.
- Ensure thorough training is completed, and provide on-the-spot training as necessary.
- Implement the project as specified in its design.
- Gain necessary commitment and approval for implementation.
- Employ a support plan and risk mitigation if necessary and document outcomes.
- Effectively communicate any changes in procedures to appropriate parties.
- Demonstrate appropriate assertiveness in presenting pharmacy and informatics concerns, solutions, and interests to external stakeholders.
- Change is implemented fully.

Goal R5.5: Assess project results and the need to make changes, if applicable (Performance/Monitoring and Closure)

Objective 5.5.1: (Evaluating) Evaluate project results. (Performance/Monitoring)

Criteria:

- Outcome of change is evaluated accurately and fully.
- Assess whether risk mitigation strategies were incorporated and outcomes thereof.
- Gain feedback from project stakeholders.
- Include operational, clinical, economic, and humanistic outcomes of patient care.
- Use continuous quality improvement (CQI) principles to assess the success of the implemented change.
- Correctly identify need for additional modifications or changes and implement.
- Accurately assess the impact of the project, including its sustainability (if applicable).
- Accurately and appropriately develop plan to address opportunities for additional changes.

Objective R5.5.2: (Creating) Effectively present the results of an informatics-related project and determine next steps. (Closure)

Criteria:

- Outcome of change is reported accurately to appropriate stakeholders(s) and policy-making bodies according to departmental or organizational processes.
- Report includes implications for changes to or improvement in pharmacy practice.
- Oral presentations to appropriate audiences within the department and organization or to external audiences use effective communication and presentation skills and tools (e.g., handouts, slides) to convey points successfully.
- Use communication skills to accommodate the target audience.
- Handoffs are completed as necessary, including documentation of key points for ongoing support.
- Participate in related project closure meetings.
- Create a written summary of the project.
- Create an article in manuscript style and suitable for possible publication.

Goal R5.6: Become proficient at planning ongoing medication-use technology and automation system maintenance or optimization projects.

Objective R5.6.1: (Applying) Formulate a plan that assures the ongoing maintenance or optimization of the organization's patient, medication, and evidence-based resources, technology and automation systems.

Criteria:

- Explain the components of a plan for the maintenance or optimization of a technology or automation system.
- Formulate a plan or procedure for ongoing system maintenance or optimization.
- Report the results of a maintenance project.

Competency Area R6: Teaching, Education, Dissemination of Knowledge, and Evaluation of Learning Activities

Goal R6.1: Provide effective education to patients, caregivers, healthcare professionals, students, and other interested stakeholders (individuals and groups).

Objective R6.1.1: (Creating) Design effective educational activities.

Criteria:

- Accurately define educational needs with regard to target audience (e.g., individual versus group) and learning level (e.g., patient versus healthcare professional roles).
- Define educational objectives that are specific, measurable, at a relevant learning level (e.g., applying, creating, evaluating), and addresses the audiences' defined learning needs.
- Plan use of teaching strategies that match learner needs, including active learning (e.g., cases, polling).
- Select content that is relevant, thorough, evidence based (using primary literature where appropriate), timely and reflects best practices.
- **Include accurate citations and relevant references and adhere to applicable copyright laws.**

Objective R6.1.2: (Applying) Use effective presentation and teaching skills to deliver education.

Criteria:

- Demonstrate rapport with learners.
- Capture and maintain learner/audience interest throughout the presentation.
- Implement planned teaching strategies effectively.
- Effectively facilitate audience participation, active learning, and engagement in various settings (e.g., small or large group, distance learning).
- Present at appropriate rate and volume and without exhibiting poor speaker habits (e.g., excessive use of "um" and other interjections).
- Exhibit appropriate body language, movement, and expressions to enhance presentations.
- Summarize important points at appropriate times throughout presentations.
- Transition smoothly between concepts.
- Effectively use audio-visual aids and handouts to support learning activities.

Objective R6.1.3: (Applying) Use effective written communication to disseminate knowledge.

Criteria:

- Write in a manner that is easily understandable and free of errors.
- Demonstrate thorough understanding of the topic(s).
- Note appropriate citations and references.
- Include critical evaluation of the literature and knowledge advancements or a summary of what is currently known on the topic.
- Develop and use tables, graphs, and figures to enhance understanding of the topic when appropriate.
- Write at a level appropriate for the target readership (e.g., physicians, pharmacists, other healthcare professionals, patients, public).
- Create one's own work and do not engage in plagiarism.

Objective R6.1.4: (Evaluating) Appropriately assess effectiveness of education.

Criteria:

- Select assessment method (e.g., written or verbal assessment or self-assessment questions, case with case-based questions, learner demonstration of new skill) that matches activity.
- Provide timely, constructive, and criteria-based feedback to learner(s).
- Write assessment questions in a clear, concise format that reflects best practices for test item construction.
- Determine how well learning objectives were met.
- Plan for follow-up educational activities to enhance or support learning and (if applicable) ensure that goals were met.
- Identify ways to improve educational skills.
- Obtain and review feedback from learners and others to improve effectiveness as an educator.

Goal R6.2: Effectively employ appropriate preceptor roles when engaged in teaching students, pharmacy technicians, or fellow healthcare professionals.

Objective R6.2.1: (Analyzing) When engaged in teaching, select a preceptor role that meets learners' educational needs.

Criteria:

- Identify which preceptor role is applicable for the situation (direct instruction, modeling, coaching, facilitating).
- Select direct instruction when learners need background content.
- Select modeling when learners have sufficient background knowledge to understand the skill being modeled.
- Select coaching when learners are prepared to perform a skill under supervision.
- Select facilitating when learners have performed a skill satisfactorily under supervision.

Competency Area R7: Leadership and Management

Goal R7.1: Demonstrate leadership skills for successful self-development.

Objective R7.1.1: (Applying) Demonstrate personal, interpersonal, and teamwork skills critical for effective leadership.

Criteria:

- Demonstrate effective time management.
- Manage conflict effectively.
- Demonstrate effective negotiation skills.
- Demonstrate ability to lead interprofessional teams.
- Use effective communication skills and styles.
- Demonstrate understanding of perspectives of various healthcare professionals.
- Effectively express benefits of personal profession-wide leadership and advocacy.

Objective R7.1.2: (Applying) Apply a process of ongoing self-evaluation and personal performance improvement.

Criteria:

- Accurately summarize personal strengths and areas for improvement (in knowledge, values, qualities, skills, and behaviors).
- Effectively use a self-evaluation process and reflection for developing professional direction, goals, and plans.
- Effectively engage in self-evaluation of progress on specified goals and plans.
- Demonstrate ability to use and incorporate constructive feedback from others.
- Effectively use principles of continuous professional development (CPD) planning (reflect, plan, act, evaluate, record/review).

Goal 7.2: Demonstrate management skills.

Objective R7.2.1: (Applying) Contribute to pharmacy departmental management.

Criteria:

- Help identify and define significant departmental and organizational needs.
- Help develop plans that address departmental and organizational needs.
- Participate effectively on committees or informal work groups to complete group projects, tasks, or goals.
- Participate effectively in implementing changes, using change management and quality improvement best practices and tools, consistent with team, departmental, and organizational goals.

Objective R7.2.2: (Applying) Manage one's practice effectively.

Criteria:

- Accurately assess successes and areas for improvement.

- Make accurate, criteria-based assessments of one’s ability to perform practice tasks.
- Regularly integrate new learning into subsequent performances of a task.
- Routinely seek applicable learning opportunities when performance does not meet expectations.
- Demonstrate effective workload and time-management skills.
- Assume responsibility for personal work quality and improvement.
- Prepare well to fulfill responsibilities (e.g., projects, management, meetings).
- Set and meet realistic goals and timelines.
- Demonstrate awareness of values, motivations, and emotions.
- Demonstrate enthusiasm, self-motivation, and a “can-do” approach.
- Strive to maintain a healthy work–life balance.
- Work collaboratively within the organization’s political and decision-making structure.
- Demonstrate pride in and commitment to the profession through appearance, personal conduct, planning to pursue certification(s), and pharmacy association membership activities.
- Demonstrate personal commitment to and adheres to organizational and departmental policies and procedures.

Goal R7.3: Represent the pharmacy informatics perspective in interactions with interprofessional teams.

Objective R7.3.1: (Applying) Demonstrate commitment to optimizing use of informatics to improve patient outcomes by achieving pharmacy informatics goals.

Criteria:

- Demonstrate importance of informatics when interacting with interprofessional teams.
- Effectively communicate importance and role of informatics in healthcare.
- Identify methods to optimize use of medication-use processes.

Objective R7.3.2: (Understanding) Explain effective strategies for establishing openly communicative, collaborative working relationships between pharmacy and the information technology staff of an organization.

Criteria:

- Understand the value of good peer relationships in the achievement of informatics projects.
- Understand the health system’s information systems organization and the links / matrix with pharmacy informatics professionals.
- Understand differences in the approach to the resolution of information flow problems between clinicians and information technology professionals.

Objective R7.3.3: (Applying) Use knowledge of organizational dynamics to effectively achieve pharmacy informatics goals.

Criteria:

- Work effectively in interprofessional teams to achieve goals.
- Demonstrate professionalism within teams.
- Strive to maintain interprofessional relationships.

Objective R7.3.4: (Applying) Participate in the development of budget estimates and financial projections for the acquisition, implementation, and maintenance of technology and automation systems.

Criteria:

- Help develop operational and capital budgeting for informatics projects.
- Demonstrate understanding of methods to estimate and measure return on investment (ROI).
- Demonstrate understanding of the need for establishing contingencies in the budget estimation process.

Objective R7.3.5: (Evaluating) Engage in effective and creative issue management and resolution when problems are encountered in pharmacy technology and automation systems.

Criteria:

- Employ proven principles for tracking informatics issues.
- Evaluate potential for an opportunity when an issue arises.
- When presented with a non-standard informatics problem, apply creative (out-of-box) thinking to its solution.

Objective R7.3.6: (Applying) Use assertive skills to successfully represent pharmacy informatics concerns and positions to internal and external audiences.

Criteria:

- Develop good peer relationships in the achievement of informatics goals.
- Assertively speak to issues related to informatics.

Goal R7.4: Represent pharmacy informatics concerns in strategic planning for the implementation, use, and maintenance of technology and automation systems.

Objective R7.4.1: (Analyzing) Participate in constructing or updating strategic plans for technology and automation systems for the medication-use process.

Criteria:

- Analyze issues and concerns that must be considered when doing strategic planning for the implementation, integration, upgrading, use, and maintenance of technology and automation used in the medication-use process working with an interprofessional team.

Goal R7.5: Demonstrate the personal leadership qualities, commitments, business and political skills necessary to advance the profession of pharmacy and informatics.

Objective R7.5.1: (Understanding) Capitalize on personal skills and interests to offer professional service.

Criteria:

- List several professional organizations in informatics and pharmacy.
- Describe opportunities for and benefits of involvement in professional organizations.
- Explain for the above organizations the potential match between the skills and knowledge needs of the organization and one's personal skills and knowledge.

ELECTIVE COMPETENCY AREAS, GOALS, AND OBJECTIVES FOR PHARMACY INFORMATICS POSTGRADUATE YEAR TWO (PGY2) PHARMACY RESIDENCIES

Competency Area E1: Conduct pharmacy informatics research.

Goal E.1: Design, execute, and report results of investigations of pharmacy informatics-related issues.

Objective E1.1.1: (Analyzing) Identify potential pharmacy informatics-related issues that need to be studied.

Criteria:

- Explain common gaps with informatics systems.
- Determine an appropriate topic for a practice-related research project of significance to patient care.
- Determine an appropriate research question or topic for a practice-related project of significance to patient care that can realistically be addressed in the desired time frame.

Objective E1.1.2: (Applying) Use a systematic procedure for performing a comprehensive literature search.

Criteria:

- Use best practice or evidence-based principles to identify opportunities for improvements.

Objective E1.1.3: (Analyzing) Draw appropriate conclusions based on a summary of a comprehensive literature search.

Objective E1.1.4: (Evaluating) Generate a research question(s) to be answered by an investigation.

Criteria:

- Explain the types of hypothesis that can be used in a research setting.

Objective E1.1.5: (Evaluating) Develop specific aims and design study methods that will answer the question(s) identified.

Criteria:

- Explain the types of metrics that can be used with informatics research.
- Explain the use of quantitative versus qualitative research.

Objective E1.1.6: (Applying) Use a systematic procedure to collect and analyze data.

Objective E1.1.7: (Evaluating) Draw valid conclusions through evaluation of the data.

Criteria:

- Accurately evaluate or assist in the evaluation of data generated by health information technology or automated systems to identify opportunities for improvement.
- Appropriately identify problems and opportunities for improvement and analyze relevant background data.

Objective E1.1.8: (Applying) Use effective communication skills to report orally and in writing the results and recommendations of an investigation into a pharmacy informatics-related issue.

Competency Area E2: Alternate site informatics practice

Description: Alternate sites may be other types of hospitals (e.g., multi-hospital systems, community, rural and small hospitals), ambulatory care, specialty pharmacy, long term care, retail, Boards of Pharmacy, associations (informatics or pharmacy), industry, National Standards Institutes, National Compendia, vendors, Health Information Exchanges, Pharmacy Benefit Managers, other facilities with PGY2 Pharmacy Informatics programs, etc. Rotations may have healthcare professionals other than pharmacists as preceptors and may consist of a site visit for orientation or complete rotation with defined Goals/Objectives as agreed upon by the Residency Program Director and alternate site Preceptor.

Goal E2.1: Demonstrate understanding of various areas of informatics practice other than the residency’s primary practice setting.

Objective E2.1.1: (Understanding) Describe how informatics principles are applied in other healthcare sites.

Goal E2.2: Describe the interaction and exchange of data between the alternate site and the primary organization site.

Objective E2.2.1: (Analysis) Analyze gaps in available data and how interoperability may be improved.

Competency Area E3: Academia

Goal E3.1: Understand faculty roles and responsibilities.

Objective E3.1.1: (Understanding) Explain variations in the expectations of different colleges/schools of pharmacy for teaching, practice, research, and service.

Criteria:

- Discuss how the different missions of public versus private colleges/schools of pharmacy can impact the role of faculty members.
- Discuss maintaining a balance between teaching, practice, research and service.
- Discuss the relationships between scholarly activity and teaching, practice, research and service.

Objective E3.1.2: (Analyzing) Explain the role and influence of faculty in the academic environment.

Criteria:

- Explain the responsibilities of faculty in governance structure (e.g., the faculty senate, committee service).
- Describe the responsibilities of faculty (e.g., curriculum development and committee service) related to teaching, practice, research, and service roles.

Objective E3.1.3: (Understanding) Describe the academic environment.

Criteria:

- Describe how the decisions by university and college administration impact the faculty.
- Discuss outside forces (e.g., change in the profession, funding source, accreditation requirements) that impact administrator and faculty roles.

Objective E3.1.4: (Understanding) Describe the types and ranks of faculty appointments.

Criteria:

- Explain the various types of appointments (e.g., non-tenure, tenure-track, and tenured faculty).
- Differentiate among the various ranks of faculty (e.g., instructor, assistant professor, associate professor, full professor).
- Discuss the role and implications of part-time and adjunct faculty as schools continue to expand and faculty shortages occur.

Objective E3.1.5: (Understanding) Discuss the promotion and/or tenure process for each type of appointment.

Criteria:

- Identify the types of activities that are considered in the promotion process.
- Identify the types of activities that are considered for tenure.

Objective E3.1.6: (Applying) Identify resources available to develop academic skills.

Criteria:

- Explain the role of academic-related professional organizations (e.g., AACP) in faculty professional development.
- Identify resources to help develop teaching skills and a teaching philosophy.

Objective E3.1.7: (Understanding) Explain the characteristics of a typical affiliation agreement between a college of pharmacy and a practice site (e.g., health system, hospital, clinic, retail pharmacy).

Criteria:

- Explain how the political environments of either a college or a health system may affect the other.

Goal E3.2: Exercise teaching skills essential to pharmacy faculty.

Objective E3.2.1: (Creating) Develop an instructional design for a class session, module, or course.

Criteria:

- Construct a student-centered syllabus.
- Construct educational objectives for a class session, module, or course that is appropriate to the audience.
- Identify appropriate instructional strategies for the class session, module, or course to achieve the objectives.
- Create assessment tools that measure student achievement of the educational objectives.

Objective E3.2.2: (Creating) Prepare and deliver didactic instruction on a topic relevant to the specialized area of pharmacy residency training.

Criteria:

- Identify educational technology that could be used for a class session, module, or course (e.g., streaming media, course management software, audience response systems).
- Create instructional materials appropriate for the topic and audience.
- Identify strategies to deal with difficult learners.
- Given feedback from teaching evaluations (e.g., student and or peer), devise a plan to incorporate improvements in future instruction.

Objective E3.2.3: (Applying) Develop and deliver cases for workshops and/or exercises for laboratory experiences.

Criteria:

- Identify the appropriate level of case-based teachings for small group instruction.
- Identify appropriate exercises for laboratory experiences.
- Provide appropriate and timely feedback to improve performance.

Objective E3.2.4: (Applying) Serve as a preceptor or co-preceptor utilizing the four roles employed in practice-based teaching (direct instruction, modeling, coaching and facilitation).

Criteria:

- Assess the learner's skill level to determine the appropriate preceptor strategy for providing practice-based teaching.
- Given performance-based criteria, identify ways to provide constructive feedback to learners.
- Develop strategies to promote professional behavior.
- Identify strategies to deal with difficult learners in the practice setting.
- Given a diverse learner population, identify strategies to interact with all groups with equity and respect.

Objective E3.2.5: (Analyzing) Develop a teaching experience for a practice setting (e.g., introductory or advanced pharmacy practice experience).

Criteria:

- Create educational goals and objectives to be achieved.
- Develop activities that will allow achievement of identified educational goals and objectives.
- Identify how and when feedback should be provided.
- Identify other preceptors for the experience, if appropriate.
- Determine training that might be needed for the preceptors to deliver student education.
- Identify potential challenges of precepting and providing informatics services simultaneously.

Objective E3.2.6: (Applying) Deliver a practice-based educational activity, including didactic or experiential teaching, or facilitation.

Criteria:

- Incorporate at least one active learning strategy in didactic experiences appropriate for the topic.
- Use effective skills in facilitating small and large groups.
- For experiential activities:
 - Organize student activities (e.g., student calendar).
 - Effectively facilitate topic discussions and learning activities within the allotted time.
 - Effectively develop and evaluate learner assignments
 - Effectively assess student performance.
 - Provide constructive feedback.

Objective E3.2.7: (Creating) Effectively document one's teaching philosophy, skills, and experiences in a teaching portfolio.

Criteria:

- Portfolio includes:
 - A statement describing one's teaching philosophy.
 - Curriculum vitae.
 - Teaching materials including slides and other handouts for each teaching experience.
 - Documented self-reflections on one's teaching experiences and skills, including strengths, areas for improvement, and plans for working on the areas for improvement.
 - Peer/faculty evaluations.
 - Student/learner evaluations.

Objective E3.2.8: (Evaluating) Compare and contrast methods to prevent and respond to academic and professional dishonesty.

Criteria:

- Evaluate physical and attitudinal methods to prevent academic dishonesty.
- Discuss methods of responding to incidents of academic dishonesty.
- Discuss the role of academic honor committees in cases of academic dishonesty.
- Identify examples and methods to address unprofessional behavior in learners.

Objective E3.2.9: (Understanding) Explain the relevance of copyright laws to developing teaching materials.

Criteria:

- Discuss copyright regulations as related to reproducing materials for teaching purposes.
 - Discuss copyright regulations as related to linking and citing on-line materials.
-

Statement on Rationale for No Appendix:

Due to the highly dynamic nature of the field of informatics, intense development in healthcare information technology, and diversity and growth of healthcare software systems, an Appendix of specific scenarios would quickly become outdated and not applicable for the life of the document. The role of the pharmacy informaticist is broad and primarily system and project management, and every health system's levels of integration and systems are different. So it is unlikely that an Appendix could cover every situation, especially considering the pace of change, not only in industry, but within individual health systems.

Therefore, the Competency Areas, Goals, and Objectives (CAGOs) for Postgraduate Year Two (PGY2) Pharmacy Informatics Residencies do not include an Appendix. The level of knowledge, understanding, and experience in all core areas or relevant issues in the field of informatics expected of graduates of PGY2 Pharmacy Informatics programs has been incorporated into the CAGOs listed above.

Approved by the ASHP Commission on Credentialing on August 15, 2017. Endorsed by the ASHP Board of Directors September 29, 2017. Developed by the ASHP Commission on Credentialing in collaboration with the ASHP Section of Pharmacy Informatics and Technology. The design group comprised the following informatics pharmacy practitioners, residency program directors, and ASHP staff:

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The effective date for implementation of these educational competency areas, goals and objectives is commencing with the entering resident class of 2018.