

Job Analysis

Pharmacy Informatics

November 2023

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Executive Summary

The Board of Pharmacy Specialties (BPS) performed a job analysis, a multi-method approach into defining a job role or competency area in terms of the relevant tasks and associated knowledge areas, in 2023 to develop the content outline and other specifications for a proposed specialty certification examination for those who specialize in pharmacy informatics. In accordance with relevant professional and accreditation standards, the study consisted of three major phases:

1. Definition of tasks and knowledge areas
2. Development, administration, and analysis of a survey
3. Finalization of the exam content outline

This report provides evidence for the exam content outline developed and its applicability to the pharmacy informatics practice area. The outcome of this study was the creation of an examination blueprint that can be used to construct the pharmacy informatics specialty certification examination such that it aligns with the competencies identified and in equal proportions across all forms (versions) of the examination.

Content Domains and Subdomains of ECO		
1	Clinical Workflow	42%
1A	Software Applications	26%
1B	Clinical Decision Support	16%
2	Operational Workflow	39%
2A	Health Information Technology	11%
2B	System Build	14%
2C	System Operation	14%
3	Data and Information Management	19%
3A	Data Structure	10%
3B	Data Analytics	9%

Introduction

The Board of Pharmacy Specialties (BPS) performed a job analysis in 2023 to develop the content outline and other specifications for a proposed specialty certification examination for those who specialize in pharmacy informatics.

A job analysis¹, sometimes called a role delineation study or practice analysis in healthcare certification settings, is a multi-method approach to defining a job role or competency area in terms of the relevant tasks or work activities and the associated competencies (operationalized as knowledge, skills, and abilities). Indeed, job analysis can also be thought of as referring to a family of related approaches to establishing the foundations of content validity² for an assessment³, in this case applied to the assessment of competencies associated with a specialty area in the licensed practice of pharmacy. A job analysis is considered a multi-method approach because it incorporates both qualitative and quantitative evidence in support of the definition the practice area in question. The job analysis consisted of three major phases:

1. Definition of tasks and knowledge areas, organized in a content outline format and completed by an assembled panel of qualified pharmacists who are currently engaged in pharmacy informatics
2. Development, administration, and analysis of a survey to other qualified pharmacists who are currently engaged in pharmacy informatics, requesting their ratings either endorsing the inclusion or exclusion of each task and knowledge area identified by the committee
3. Finalization of the exam content outline, completed by the assembled panel and with consideration given to the survey results to help determine the retention, discard, or editing of knowledge and task lists, as well as the relative weights assigned to each content area

The study described in this report was conducted according to the Standards for Educational & Psychological Testing⁴ and applicable accreditation standards (NCCA⁵ and ISO/IEC 17024⁶). The subsequent sections describe the methods, results, and outcomes of the study, complemented by appendices which describe the qualifications and professional characteristics of the subject matter experts who contributed to this study, the actual text of the survey administered, and the final exam content outline produced by this study.

¹ Sackett, P.R., Laczko, R.M. (2003). Job and Work Analysis. Handbook of Psychology.

² Cronbach, L.J., Meehl, P.E. (1955). Construct Validity in Psychological Tests. Psychological Bulletin, 52(4), 281-302.

³ Kane, M.T. (2013). Validating the Interpretations and Uses of Test Scores. Journal of Educational Measurement, 50(1), 1-73.

⁴ American Educational Research Association, the American Psychological Association, National Council on Measurement in Education. (2014). Standards for Educational & Psychological Testing.

⁵ National Commission for Certifying Agencies. (2014). Standards for the Accreditation of Certification Programs.

⁶ International Organization for Standardization, International Electrotechnical Commission. (2012). Conformity Assessment: General Requirements for Bodies Operating Certification of Persons.

1. Definition of Tasks and Knowledge

BPS assembled a group of 57 subject-matter experts (SMEs) in pharmacy informatics, who were representative of the diversity of professional characteristics within the specialty with respect to practice setting, patient populations served, years of experience, and geographic dispersion within the United States. See Appendix A for the qualifications and professional characteristics of the job analysis panel and interviewees.

The SMEs were divided into four focus groups, each with approximately 15 participants. The focus groups were conducted via teleconference to develop, define, and update the tasks performed and knowledge required to practice as a specialist in pharmacy informatics. The dates of the meetings were 4 August, 9 August, 18 August, and 30 August in 2023.

At the beginning of each session, SMEs were oriented to the objectives of the study and the meeting, and then were presented a draft examination content outline and list of associated tasks. Each focus group built upon the work of the previous groups, further editing and refining with each iteration. See Appendix B for the presentation used to orient the job analysis panelists.

The SMEs developed 15 task statements that describe the work activities performed by an informatics pharmacist.

- | | |
|----|---|
| 1 | Design and develop health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders |
| 2 | Evaluate and procure health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders |
| 3 | Implement and integrate health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders |
| 4 | Maintain, support, and optimize health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders |
| 5 | Conduct needs assessment and determine applicability of available information technologies to pharmacy practice, education, administration, and research |
| 6 | Configure and maintain databases to ensure the integrity, usability, and access of the data |
| 7 | Perform data analysis, visualization, interpretation, and reporting related to clinical services, medication-use process, pharmacy operations, and patient outcomes |
| 8 | Evaluate financial integrity related to the medication-use process across the continuum of care |
| 9 | Design, implement, and evaluate clinical decision support used in the medication-use process across the continuum of care |
| 10 | Develop policies, procedures, and training materials for the utilization of health information technology, systems, and workflows |

11	Ensure compliance with legal and regulatory requirements as well as standards and best practices in healthcare and information technology
12	Design, implement, and evaluate business continuity procedures, including downtime preparedness, redundancy, and system recovery
13	Develop and provide education and training to healthcare professionals, information technology professionals, and learners about pharmacy informatics
14	Lead and/or participate in governance, change management, project management, and process improvement associated with health information technology, systems, and workflows
15	Engage in continuous professional development in pharmacy informatics, such as committee involvement, scholarly activities, and continuing education

The SMEs identified three content domains that describe the key high-level components of pharmacy informatics. Across the three content domains, seven content sub-domains were identified and 45 knowledge areas were developed that describe specific job knowledge associated with the practice of pharmacy informatics. In some cases, the panelists wrote examples in parenthesis, which are meant to be non-exhaustive, to help better illustrate the intended scope of the knowledge area listed.

1	Clinical Workflow
1A	Software Applications
1A1	Ordering and Prescribing Functions (e.g., CPOE, e-prescribe, real-time prescription benefits, electronic prior authorization)
1A2	Verification Functions (e.g., auto-verification, dual-verification, product selection, formulary management)
1A3	Preparation and Compounding Functions (e.g., batch preparation, patient-specific preparation, IV workflow technology, repackaging)
1A4	Dispensing and Distribution Functions (e.g., equivalency mapping, dispensing hierarchy/logic, medication-fill automation, diversion prevention)
1A5	Administration Functions (e.g., BCMA, MAR, standardization of routes and frequencies, smart pump library management)
1A6	Monitoring Functions (e.g., PDMP, adverse event reporting, medication adherence, REMS, registries, immunizations, MTM)
1A7	Inventory Management Functions (e.g., persistent inventory, procurement, medication tracking, drug shortage and recall management)
1A8	Documentation and Communication Functions (e.g., documentation templates, clinic notes, messaging, care coordination, patient education, patient-facing EHR)
1A9	Transitions of Care Functions (e.g., medication reconciliation, external order history, prior authorization)
1B	Clinical Decision Support
1B1	Five Rights of Clinical Decision Support
1B2	Active Clinical Decision Support (e.g., FSV, custom alerts, medication warnings, alert fatigue)

1B3	Passive Clinical Decision Support (e.g., defaults, pathways, order sets, templates, reminders, guidelines, dashboards)
1B4	Clinical Patient Monitoring (e.g., medication stewardship, acuity/prioritization, pharmacogenomics and precision medicine)
1B5	Advanced Decision Support (e.g., probability modeling)
1B6	Medication Safety Best Practices (e.g., ISMP, TJC, CMS, leapfrog)
2	Operational Workflow
2A	Health Information Technology
2A1	Ordering and Verification Technology (e.g., computers, document scanners, security tokens, smartphones)
2A2	Preparation and Compounding Technology (e.g., compounders, repackagers, robotics, scales, cameras)
2A3	Dispensing and Distribution Technology (e.g., conveyor belts, pill counters, robotic delivery, kits/trays/carts, tube systems, cabinets, medication tracking)
2A4	Administration Technology (e.g., smart pumps, barcode scanners, reminders)
2A5	Monitoring Technology (e.g., telemetry, telehealth, app-integrated technology, wearable devices, digiceuticals)
2A6	Inventory Management Technology (e.g., point-of-sale systems, carousels, refrigerators, printers, asset tagging, RFID)
2B	System Build
2B1	Medication Build and Maintenance (e.g., drug database updates, vendor updates, research protocols, investigational drugs)
2B2	System Build and Maintenance (e.g., UI/UX, GUI, code upgrades, user support, issue management, downtime procedures)
2B3	System Implementation and Evaluation (e.g., service and product procurement, vendor management, SDLC)
2B4	System and Device Integration (e.g., API, external systems)
2B5	Interoperability Standards (e.g., standardized medication profile, pharmacist eCare plan, HIE)
2B6	Coding Standards (e.g., NDC, RxNorm, SNOMED CT, LOINC, CPT, ICD10/11, HL7, NCPDP)
2C	System Operation
2C1	Financial Integration (e.g., 340B, X12, claims, adjudication, drug pricing, revenue integrity, COA vs. COD, cost transparency)
2C2	Project and Workflow Management (e.g., Gantt, Vizio, critical path, PDSA, KPIs, budgeting, resources)
2C3	Change Management (e.g., training, system adoption, release scheduling, testing methods)
2C4	Quality Management and Process Improvement (e.g., root cause analysis, troubleshooting, data collection)
2C5	Governance (e.g., risk management, policies and procedures, business continuity, system security, user access)
2C6	Legal and Regulatory Requirements (e.g., HIPAA, HITECH act, 21st century cures act, DEA)
3	Data and Information Management
3A	Data Structure

3A1	Data Models (e.g., entity relationship model, relational and non-relational databases, hierarchical model)
3A2	Logic Concepts (e.g., if, or, xor, and, then, Boolean, case statements)
3A3	Data Types (e.g., quantitative, qualitative, structured, unstructured, free text, discrete, continuous)
3A4	Data Governance (e.g., ethics, data integrity, data security, privacy)
3A5	Referential Compendia (e.g., drug information databases)
3B	Data Analytics
3B1	Analytics Tools (e.g., MS excel, R, SQL, Python)
3B2	Statistical Analysis and Research Methods
3B3	Data Storage (e.g., disparate data sources, warehouses, cloud storage, data lake)
3B4	Data Preparation and Cleaning
3B5	Data Analysis and Interpretation (e.g., prescriptive vs. descriptive, forecasting, predictive analytics)
3B6	Data Reporting and Visualization (e.g., audience analysis, dashboards, charts, graphs, data storytelling, automated reporting)
3B7	Machine Learning and Artificial Intelligence

The SMEs also helped create a definition of the informatics pharmacist by writing a statement describing the target population and purpose of a BPS credentialing program if it were to be established for pharmacy informatics.

The BPS Board-Certified Informatics Pharmacist program is a credential for pharmacists who specialize in the design, implementation, integration, maintenance, support, and/or optimization of health information technology, systems, and workflows focused on the medication-use process, patient care, and health outcomes.

The purpose of the BPS Board-Certified Informatics Pharmacist program is to validate that the pharmacist has the advanced knowledge, skills, and experience necessary to design, implement, integrate, maintain, support, and optimize health information technology, systems, and workflows to promote safety, efficacy, and efficiency of the medication-use process, patient care, and health outcomes.

The SMEs also refined a list of demographic questions to be provided to survey respondents which would help better understand the professional characteristics of the respondent sample, which is described in more detail in the next section.

Lastly, 16 SMEs participated in a linkage analysis, which is an exercise to identify the inter-relationships among the knowledge areas and tasks. Each participant was asked to individually develop a linkage matrix in which tasks are listed as columns and knowledge areas as rows, and an x-mark indicating that the knowledge area is required for performance of the task. Individual matrices were aggregated such that any proposed linkage (x-mark) by more than half of the participants was counted in the final (consensus) linkage matrix. All but one knowledge statement (3B7) had at least one linkage and all the task statements had at least one linkage.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1															
1A															
1A1	X	X	X	X					X	X	X	X	X		
1A2	X	X	X	X						X					
1A3	X	X	X	X						X		X			
1A4	X	X	X	X	X					X					
1A5	X	X	X	X						X					
1A6	X	X	X	X	X					X	X				
1A7	X	X	X	X				X		X					
1A8	X	X	X	X						X			X		
1A9	X	X	X	X	X					X					
1B															
1B1									X				X		
1B2	X	X	X	X	X				X				X		
1B3	X		X	X	X				X				X		
1B4	X	X	X	X					X				X		
1B5									X						
1B6			X						X	X	X			X	
2															
2A															
2A1	X	X	X	X	X					X		X	X		
2A2		X	X	X	X					X		X	X		
2A3	X	X	X	X	X					X		X	X		
2A4		X	X	X	X					X		X	X		
2A5		X	X	X	X					X		X	X		
2A6		X	X	X						X		X	X		
2B															
2B1	X	X	X	X											
2B2			X	X											
2B3		X	X												
2B4			X	X											
2B5			X	X											
2B6			X	X							X				

2C									
2C1						X			
2C2		X							X
2C3		X	X					X	X
2C4					X				X
2C5							X	X	X
2C6							X	X	X
3									
3A									
3A1					X	X			
3A2					X	X			
3A3					X	X			
3A4					X	X			X
3A5					X				
3B									
3B1						X			
3B2						X			X
3B3					X	X			
3B4						X			
3B5						X			
3B6						X			
3B7									

2. Survey Administration and Analysis

A survey was created for the purpose of soliciting ratings of endorsement from the larger practitioner population. Survey results are used to validate the appropriateness of the knowledge areas and tasks developed by the panelists and to inform content weighting decisions. The survey was developed with the following components:

- Description of the purpose of the survey
- Definition of the target population identified by the specialty practice area
- Respondent ratings of endorsement for the task statements
- Respondent ratings of endorsement for the knowledge areas
- Demographic questions that assess survey respondents' professional qualifications
- Open field for any additional comments

The ratings of endorsement from the survey respondents were solicited using two scales: Importance and Frequency. Each scale consists of a prompt for task statement, prompt for knowledge areas, and numerical responses with an associated text anchor (description).

Importance	How important is this task to pharmacy informatics practice?
	How important is this knowledge area to pharmacy informatics practice?
0	not at all / not applicable
1	of very little importance
2	somewhat important
3	moderately important
4	very important
5	critically important
Frequency	How frequently is this task performed in pharmacy informatics practice?
	How frequently is this knowledge used in pharmacy informatics practice?
0	not at all / not applicable
1	very rarely
2	rarely
3	occasionally
4	often
5	very often

The survey was pilot tested with a sample that consisted of the job analysis panelists, the specialty examination council, and BPS staff persons. The pilot test was conducted during the dates of 21 September and 1 October 2023. Pilot testers identified the opportunity to add an additional demographic question asking which non-BPS certifications related to informatics respondents have. See Appendix C for a copy of the final survey text.

The survey was open and available from 4 October to 5 November 2023. All pharmacists who hold a BPS credential were directly invited via email to complete the online survey. The survey was also

disseminated through the following affiliate organizations: American College of Clinical Pharmacy (ACCP) and American Society of Health-System Pharmacists (ASHP).

The survey yielded 308 usable responses. Responses were not used if the survey was not completed or if the respondent indicated spending less than 50% of their pharmacy practice in pharmacy informatics.

Responses to Demographic Questions		
Percentage of Time in Pharmacy Informatics	Mean = 93.44 SD = 13.37	<i>n</i>
0 – 50		0
51 – 75		36
76 – 99		53
100		219
Post-Graduate Pharmacy Residency Programs		<i>n</i>
PGY1 Pharmacy		130
PGY1 Managed Care Pharmacy		3
PGY1 Community-Based Pharmacy		6
PGY2 Ambulatory Care Pharmacy		0
PGY2 Cardiology Pharmacy		1
PGY2 Clinical Pharmacogenomics		1
PGY2 Community-Based Pharmacy Administration and Leadership		2
PGY2 Corporate Pharmacy Administration and Leadership		1
PGY2 Critical Care Pharmacy		5
PGY2 Emergency Medicine Pharmacy		2
PGY2 Geriatric Pharmacy		1
PGY2 Health System Pharmacy Administration and Leadership		7
PGY2 Infectious Diseases Pharmacy		1
PGY2 Internal Medicine Pharmacy		2
PGY2 Investigational Drugs and Research		0
PGY2 Medication Use Safety and Policy		3
PGY2 Neurology		1
PGY2 Oncology Pharmacy		2
PGY2 Palliative Care / Pain Management Pharmacy		0
PGY2 Pediatric Pharmacy		4
PGY2 Pharmacotherapy		3
PGY2 Pharmacy Informatics		30
PGY2 Population Health Management and Data Analytics Pharmacy		1
PGY2 Psychiatric Pharmacy		2
PGY2 Solid Organ Transplant Pharmacy		0
PGY2 Specialty Pharmacy Administration and Leadership		0
Other: ASHP General Residency, PGY2 in Drug Information		2

BPS Certifications		n	
BCACP - Ambulatory Care		4	
BCCCP - Critical Care		5	
BCCP - Cardiology		2	
BCEMP - Emergency Medicine		1	
BCGP - Geriatric		4	
BCIDP - Infectious Diseases		0	
BCNP - Nuclear		1	
BCNSP - Nutrition Support		0	
BCOP - Oncology		11	
BCPP - Psychiatric		1	
BCPPS - Pediatric		1	
BCPS - Pharmacotherapy		111	
BCSCP - Compounded Sterile Preparations		3	
BCTXP - Solid Organ Transplantation		0	
Pharmacy Informatics Certifications		n	
AMIA Certified Health Informatics Professional (ACHIP)		8	
AMIA Health Informatics Certification (AHIC)		0	
ASHIM Certified Health Informatics System Professional (CHISP)		0	
CSSC Lean Six Sigma Black Belt		4	
HIMSS Certified Associate in Healthcare Information and Management Systems (CAHIMS)		5	
HIMSS Certified Professional in Healthcare Information and Management Systems (CPHIMS)		22	
PMI Project Management Professional (PMP)		6	
Scrum Alliance Certified Scrum Product Owner (CSPO)		2	
Scrum Alliance Certified ScrumMaster (CSM)		2	
Other		38	
Years of Experience in Pharmacy Practice		Mean = 15.86 SD = 9.56	n %
0-5			28 9.09%
6-10			76 24.68%
11-15			75 24.35%
16-20			57 18.51%
20+			72 23.38%
Years of Experience in Pharmacy Informatics		Mean = 8.84 SD = 6.77	n %
0-5			122 36.36%
6-10			108 35.06%
11-15			50 16.23%
16-20			22 7.14%
20+			16 5.19%
Primary Practice Setting			n %
Academic Institution / Educational Institution			20 6.49%

Academic Medical Center or Hospital	107	34.74%
Children's Hospital	16	5.19%
Community Hospital	64	20.78%
Community Pharmacy	4	1.30%
Home Infusion / Ambulatory Infusion	5	1.62%
Hospice	0	0.00%
Hybrid Academic-Community Hospital	12	3.90%
Integrated Health System / Accountable Care Organization	38	12.34%
Investigational Drug Service	0	0.00%
Long-Term Care Pharmacy	0	0.00%
Managed Care	6	1.95%
Outpatient Clinic / Ambulatory Clinic	3	0.97%
Pharmaceutical Industry	1	0.32%
Specialty Pharmacy	0	0.00%
Governmental Healthcare Facility / Veterans Affairs Hospital	15	4.87%
Other	17	5.52%
Location of Primary Practice	n	%
United States	298	96.7%
AL	1	0.3%
AZ	5	1.6%
CA	28	9.1%
CO	4	1.3%
CT	2	0.7%
DC	1	0.3%
DE	1	0.3%
FL	19	6.2%
GA	6	2.0%
IA	1	0.3%
ID	3	1.0%
IL	10	3.3%
IN	12	3.9%
KS	4	1.3%
KY	9	2.9%
LA	4	1.3%
MA	9	2.9%
MD	7	2.3%
ME	2	0.7%
MI	5	1.6%
MN	6	2.0%
MO	10	3.3%
MS	1	0.3%

MT	1	0.3%
NC	9	2.9%
NE	1	0.3%
NH	2	0.7%
NJ	1	0.3%
NM	3	1.0%
NV	2	0.7%
NY	18	5.8%
OH	20	6.5%
OK	1	0.3%
OR	3	1.0%
PA	7	2.3%
RI	4	1.3%
SC	7	2.3%
SD	2	0.7%
TN	16	5.2%
TX	19	6.2%
UT	3	1.0%
VA	7	2.3%
VT	1	0.3%
WA	8	2.6%
WI	10	3.3%
WV	1	0.3%
[unspecified]	2	0.7%
Outside of the United States	10	3.3%
Canada	1	0.3%
Egypt	2	0.7%
Singapore	6	2.0%
United Arab Emirates	1	0.3%
Time Spent in Professional Role	<i>n</i> (>50%)	Average %
Direct Patient Care	3	3.34%
System & Technology Support	225	70.71%
Administration / Management	15	14.59%
Teaching / Precepting	1	5.44%
Research / Scholarship	1	2.10%
Other	4	2.86%

Mean Ratings for Task Statements		Importance	Frequency
1	Design and develop health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders	4.50	4.35
2	Evaluate and procure health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders	4.04	3.48
3	Implement and integrate health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders	4.48	4.07
4	Maintain, support, and optimize health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders	4.68	4.73
5	Conduct needs assessment and determine applicability of available information technologies to pharmacy practice, education, administration, and research	3.46	3.05
6	Configure and maintain databases to ensure the integrity, usability, and access of the data	3.94	3.72
7	Perform data analysis, visualization, interpretation, and reporting related to clinical services, medication-use process, pharmacy operations, and patient outcomes	4.06	3.93
8	Evaluate financial integrity related to the medication-use process across the continuum of care	3.48	3.18
9	Design, implement, and evaluate clinical decision support used in the medication-use process across the continuum of care	4.39	4.09
10	Develop policies, procedures, and training materials for the utilization of health information technology, systems, and workflows	3.57	3.14
11	Ensure compliance with legal and regulatory requirements as well as standards and best practices in healthcare and information technology	4.01	3.46
12	Design, implement, and evaluate business continuity procedures, including downtime preparedness, redundancy, and system recovery	3.85	2.70
13	Develop and provide education and training to healthcare professionals, information technology professionals, and learners about pharmacy informatics	3.48	3.04
14	Lead and/or participate in governance, change management, project management, and process improvement associated with health information technology, systems, and workflows	4.13	3.94
15	Engage in continuous professional development in pharmacy informatics, such as committee involvement, scholarly activities, and continuing education	3.33	3.01

Mean Ratings for Knowledge Statements		Importance	Frequency
1	Clinical Workflow		
1A	Software Applications		
1A1	Ordering and Prescribing Functions (e.g., CPOE, e-prescribe, real-time prescription benefits, electronic prior authorization)	4.44	4.41
1A2	Verification Functions (e.g., auto-verification, dual-verification, product selection, formulary management)	4.43	4.33
1A3	Preparation and Compounding Functions (e.g., batch preparation, patient-specific preparation, IV workflow technology, repackaging)	4.09	3.96
1A4	Dispensing and Distribution Functions (e.g., equivalency mapping, dispensing hierarchy/logic, medication-fill automation, diversion prevention)	4.31	4.13
1A5	Administration Functions (e.g., BCMA, MAR, standardization of routes and frequencies, smart pump library management)	4.31	4.03
1A6	Monitoring Functions (e.g., PDMP, adverse event reporting, medication adherence, REMS, registries, immunizations, MTM)	3.50	3.16
1A7	Inventory Management Functions (e.g., persistent inventory, procurement, medication tracking, drug shortage and recall management)	3.65	3.50
1A8	Documentation and Communication Functions (e.g., documentation templates, clinic notes, messaging, care coordination, patient education, patient-facing EHR)	3.52	3.23
1A9	Transitions of Care Functions (e.g., medication reconciliation, external order history, prior authorization)	3.68	3.20
1B	Clinical Decision Support		
1B1	Five Rights of Clinical Decision Support	4.28	3.86
1B2	Active Clinical Decision Support (e.g., FSV, custom alerts, medication warnings, alert fatigue)	4.34	4.11
1B3	Passive Clinical Decision Support (e.g., defaults, pathways, order sets, templates, reminders, guidelines, dashboards)	4.29	4.25
1B4	Clinical Patient Monitoring (e.g., medication stewardship, acuity/prioritization, pharmacogenomics and precision medicine)	3.63	3.31
1B5	Advanced Decision Support (e.g., probability modeling)	2.85	2.26
1B6	Medication Safety Best Practices (e.g., ISMP, TJC, CMS, leapfrog)	4.15	3.67
2	Operational Workflow		
2A	Health Information Technology		
2A1	Ordering and Verification Technology (e.g., computers, document scanners, security tokens, smartphones)	3.58	3.29
2A2	Preparation and Compounding Technology (e.g., compounders, repackagers, robotics, scales, cameras)	3.60	3.30
2A3	Dispensing and Distribution Technology (e.g., conveyor belts, pill counters, robotic delivery, kits/trays/carts, tube systems, cabinets, medication tracking)	3.43	3.27
2A4	Administration Technology (e.g., smart pumps, barcode scanners, reminders)	3.94	3.65
2A5	Monitoring Technology (e.g., telemetry, telehealth, app-integrated technology, wearable devices, digiceuticals)	2.30	1.92
2A6	Inventory Management Technology (e.g., point-of-sale systems, carousels, refrigerators, printers, asset tagging, RFID)	3.29	3.05
2B	System Build		
2B1	Medication Build and Maintenance (e.g., drug database updates, vendor updates, research protocols, investigational drugs)	4.64	4.58
2B2	System Build and Maintenance (e.g., UI/UX, GUI, code upgrades, user support, issue management, downtime procedures)	3.93	3.57
2B3	System Implementation and Evaluation (e.g., service and product procurement, vendor management, SDLC)	3.31	2.78
2B4	System and Device Integration (e.g., API, external systems)	3.33	2.75

2B5	Interoperability Standards (e.g., standardized medication profile, pharmacist eCare plan, HIE)	3.28	2.70
2B6	Coding Standards (e.g., NDC, RxNorm, SNOMED CT, LOINC, CPT, ICD10/11, HL7, NCPDP)	3.53	3.15
2C	System Operation		
2C1	Financial Integration (e.g., 340B, X12, claims, adjudication, drug pricing, revenue integrity, COA vs. COD, cost transparency)	3.72	3.37
2C2	Project and Workflow Management (e.g., Gantt, Vizio, critical path, PDSA, KPIs, budgeting, resources)	3.14	3.01
2C3	Change Management (e.g., training, system adoption, release scheduling, testing methods)	3.85	3.75
2C4	Quality Management and Process Improvement (e.g., root cause analysis, troubleshooting, data collection)	3.87	3.59
2C5	Governance (e.g., risk management, policies and procedures, business continuity, system security, user access)	3.59	3.27
2C6	Legal and Regulatory Requirements (e.g., HIPAA, HITECH act, 21st century cures act, DEA)	3.67	2.93
3	Data and Information Management		
3A	Data Structure		
3A1	Data Models (e.g., entity relationship model, relational and non-relational databases, hierarchical model)	3.09	2.79
3A2	Logic Concepts (e.g., if, or, xor, and, then, Boolean, case statements)	3.39	3.24
3A3	Data Types (e.g., quantitative, qualitative, structured, unstructured, free text, discrete, continuous)	3.35	3.18
3A4	Data Governance (e.g., ethics, data integrity, data security, privacy)	3.41	2.84
3A5	Referential Compendia (e.g., drug information databases)	3.41	3.12
3B	Data Analytics		
3B1	Analytics Tools (e.g., MS excel, R, SQL, Python)	3.83	3.89
3B2	Statistical Analysis and Research Methods	2.66	2.30
3B3	Data Storage (e.g., disparate data sources, warehouses, cloud storage, data lake)	2.71	2.31
3B4	Data Preparation and Cleaning	2.94	2.68
3B5	Data Analysis and Interpretation (e.g., prescriptive vs. descriptive, forecasting, predictive analytics)	3.06	2.70
3B6	Data Reporting and Visualization (e.g., audience analysis, dashboards, charts, graphs, data storytelling, automated reporting)	3.48	3.28
3B7	Machine Learning and Artificial Intelligence	2.58	1.74

An exploratory factor analysis⁷ using maximum likelihood extraction and varimax rotation⁸ was performed on the importance ratings provided for the knowledge areas. One factor emerged, with an eigenvalue of 13.932, as the primary factor explaining 30.96% of the variability in importance ratings. A second factor emerged, with an eigenvalue of 10.61, as a potential secondary factor but it explained significantly less (10.61%) of the variability in importance ratings. All subsequent factors had eigenvalues of 2.30 or less and each explained less than 5.11% of the variability in importance ratings. This provides additional evidence for the consistency of the knowledge areas developed and their applicability to the intended measurement construct.

⁷ Thompson, B. (2004). Exploratory and confirmatory factor analysis: Understanding concepts and applications. American Psychological Association: Washington DC.

⁸ Kaiser, H. (1958). The varimax criterion for analytic rotation in factor analysis. Psychometrika, 23(3).

3. Finalization of Exam Content Outline

Of the 57 pharmacists that participated in the focus group discussions, a panel of 13 was assembled to reconvene on 29 November 2023 via teleconference and review the results of the survey and to finalize the exam content outline.

The panelists reviewed the results of the survey demographic questions and deemed the respondent sample to be representative of the target population, which are pharmacists specializing in pharmacy informatics.

The panelists agreed to retain all the task statements developed. The panelists agreed to retain all the knowledge statements developed, save for three changes. 2A5 (Monitoring Technology) was combined with 2A4 (Administration Technology) so that it reads: Administration and Monitoring Technology (e.g., smart pumps, barcode scanners, reminders, app-integrated technology, wearable devices, digiceuticals). 3B3 (Data Storage) was combined with 3B4 (Data Preparation and Cleaning) so that it reads: Data Storage, Preparation, and Cleaning. 3B7 (Machine Learning and Artificial Intelligence) was discarded but “ML/AI” was included as an example in 3A1 (Analytics Tools). All sections of the examination content outline were re-numbered in the final version accordingly. The panelists noted that some areas were rated lower in terms of importance and frequency, but should still be retained, because they are often the purview of a non-pharmacist but informatics pharmacists must possess knowledge in that area, are expected to contribute to that area, and it is anticipated that pharmacists will increasingly take the lead in that content area.

Lastly, the panelists were tasked with determining the content weighting, the proportion of examination content to be distributed to each content domain and sub-domain. The sum of the mean criticality ratings for the knowledge areas in each domain was tabulated and compared against the sum of the mean criticality ratings for all knowledge areas.

	Content Domains and Subdomains of ECO	Criticality	Draft % Weight	Final % Weight
1	Clinical Workflow			42%
1A	Software Applications	137.09	25.95%	26%
1B	Clinical Decision Support	86.34	16.35%	16%
2	Operational Workflow			39%
2A	Health Information Technology	59.22	11.21%	11%
2B	System Build	73.65	13.94%	14%
2C	System Operation	72.82	13.79%	14%
3	Data and Information Management			19%
3A	Data Structure	50.55	9.57%	10%
3B	Data Analytics	48.56	9.19%	9%

See Appendix D for the final Examination Content Outline.

Appendix A – Subject Matter Experts

Name	Credentials	Post-Licensure Experience	Job Title	Employer/Affiliation	Location
Adam Christopher Moss	PharmD, MPS	1 Year	Informatics Pharmacist	HCA Florida Ft. Walton-Destin Hospital	FL
Adrienne Drucker	PharmD, BCPS, CPHIMS	15 Years	Senior Application Coordinator, Support Lead	Mass General Brigham	MA
Ali Amin Daher Taha	PharmD, PMP, ITIL	4 Years	Senior Attending Systems Analyst	Sheikh Shakhbout Medical City	ON
Anders Westanmo	PharmD, MBA, ACHIP, FAMIA	20 Years	Clinical Pharmacy Informaticist	Veterans Health Administration	MN
Ashley Coccarelli	PharmD, BCPS	13 Years	Clinical Informatics Specialist	Cleveland Clinic	OH
Barry McClain	PharmD, MS	14 Years	Director of Pharmacy Information Systems	Advocate Health	WI
Brandi Gore	PharmD, MHA, AMIA 10x10	5 Years	Pharmacy Informatics & Analytics Program Manager	Dept of Veteran Affairs	OR
Brendan R Begnoche	PharmD, Epic Willow	5 Years	Clinical Pharmacy Manager - Informatics	Montefiore Medical Center	NY
Brett James Bailey	PharmD	7 Years	Associate Chief Clinical Informatics Officer	University of Arkansas for Medical Sciences	AR
Calvin Clay Daniels	PharmD, PhD, DPLA, BCPPS	10 Years	Manager, Clinical Decision Support	St. Jude Children's Research Hospital	TN
Connie Saltsman	PharmD, MBA, CPHIMS, FHIMSS	25 Years	AVP Clinical Pharmacy Informatics	HCA Healthcare	TN
Curtis L. Petty, Jr.	PharmD, MHA, CPHIMS	18 Years	Lead Clinical Pharmacy Informaticist	Memorial Hermann Health System	TX

Cynthia Nguyen	PharmD, BCACP	12 Years	Epic Analyst II	University Health	TX
Daniel Yarabinec	PharmD, BCPS	11 Years	Pharmacist, Information Technology	UPMC Hillman Cancer Center	PA
David Aguero	PharmD, MSTL, ACHIP, DPLA	10 Years	Director, Medication Systems and Informatics	St. Jude Children's Research Hospital	TN
Don Roosan	PharmD, PhD	14 Years	Assistant Professor	Western University of Health Sciences	CA
Erica Feinberg	PharmD, BCPS	10 Years	Sr. Clinical Data Analyst	Mckesson/US oncology Network	TN
Evan William Colmenares	PharmD	6 Years	System Clinical Manager, Pharmacy Analytics & Outcomes	UNC Health	NC
Hanh Chu	PharmD, MBA	17 Years	Senior Director - Pharmacy Informatics & Technology	Visante, Inc	MA
Hayden Pehl	PharmD, MBA, DPLA	4 Years	System Supervisor Pharmacy Informatics	UofL Health	KY
Jeremy Campbell	PharmD, MSHI, CPHQ, CPPS	10 Years	Director, Outcomes & Analytics	Pfizer	IN
John Daniel	PharmD, BCPS	6 Years	Pharmacy Informatics Specialist	St. Peter's Hospital	NY
John H. Hudson	PharmD, BCPS	12 Years	Informatics Pharmacy Specialist	Charleston Area Medical Center	WV
Julie Pawola	PharmD	20 Years	Clinical Informatics Pharmacist	UW Health	WI
Karl F. Gumpfer	MSMI, BS Pharm, CPHIMS, FASHP	32 Years	Director of Pharmacy Informatics and Automation	Boston Children's Hospital	MA
Karl Renius	PharmD, BCOP	9 Years	Pharmacy Analytics Manager	University of Michigan Health	MI

Kevin C. Marvin	BS Pharmacy, MS, FASHP, FHIMSS	42 Years	Informatics Pharmacist Consultant	Visante Inc. and Self Employed	VT
Kevin Y.L. Yap	PhD, MEng, SDMC, CBDSA, CEH, CME, SRPharmS	20 Years	Pharmacy Practice Manager	Singapore General Hospital	Singapore
Kimberly Pietropola	PharmD, BCPS, Epic Willow	18 Years	Systems Change Coordinator	The Johns Hopkins Hospital	MD
Kristina Lee	PharmD, BCPS	11 Years	Informatics Pharmacist II	Baptist Health South Florida	FL
Lorne E. Basskin	PharmD	28 Years	President and CEO	Strategic Economics Ltd.	NC
Lynn Boecler	PharmD, MS	32 Years	Senior Director, Pharmacy Services and Pharmacy Informatics	NorthShore - Edward Elmhurs	IL
Marc Willner	PharmD	11 Years	Lead Pharmacy Informatics Specialist	Cleveland Clinic	OH
Mark Baumgart	BSPHarm, PharmD	28 Years	Clinical Quality Analyst	Wolters Kluwer Health - Medi-Span	IN
Michael David Schmidt	PharmD, MBA, RPh, CCHP, BCMTMS, CPBS, CPhT	7 Years	Clinical Pharmacist/Applicati on Specialist	Tri-City Medical Center	CA
Michael Moore	BS, MBA, BCPS, RPH, PMP, CPHIMS, 340B ACE	29 Years	Informatics Pharmacist	Kingman Regional Medical Center	AZ
Michael Reed	BS, BCCCP, BCOP, BCPS	33 Years	Clinical Pharmacist	UW Health	WI
Monica Layne Ferroni-Sakasegawa	PharmD, CPHIMS	29 Years	Clinical Informatics Specialty Pharmacist	Palomar Health and HHSA San Diego County	CA
Nicole Elizabeth Epplin	PharmD, Epic Willow, Basic BPA, Adv. BPA, Data Courier	16 Years	Epic Willow Consultant	CSI (contracted with University Hospitals Cleveland)	IL

Nicole Salata	PharmD, MS, MBA, BCGP	13 Years	Clinical Informatics and Analytics Pharmacist	Teladoc Health	IL
Qian Zhao	PharmD, MHIIM, BCPS, CPHIMS	6 Years	Clinical Informatics Pharmacist	MedStar Health	MD
Raymond Ngo	PharmD, BCPPS, BCPS	8 Years	Information Technology Pharmacist	Valley Children's Healthcare	CA
Russell Dunn	PharmD, BCACP	9 Years	Clinical Pharmacy Informatics Coordinator	Lifespan	RI
Ryan Cello	PharmD	18 Years	Pharmacy Supervisor- Automation, Informatics, Analytics and Diversion	UC Davis Health	CA
Ryan Douglas Staker	PharmD, MBA, CPPS	10 Years	IT Pharmacy Consultant	Genesis HealthCare System	OH
Sarah Ferrell	PharmD, BCPPS	6 Years	Clinical Pharmacy Specialist, Informatics	Parkview Health	IN
Scott Myers	PharmD, MS	4 Years	Clinical Pharmacist Specialist II - Informatics	University Health	TX
Sean Jeffery	PharmD, BCGP, FASCP, AGSF	28 Years	Director of Pharmacy and Clinical Professor	University of Connecticut & Hartford HealthCare	CT
Sean Stephan Garcia	PharmD, CPHIMS, CSM, CSPO, Tableau Desktop Specialist	9 Years	Senior Clinical Pharmacy Informaticist	Memorial Hermann Health System	TX
Shelly Spiro	BSPHarm, FASCP	47 Years	Executive Director	Spiro Consulting	DC
Sonya Zhan	PharmD, MSHI	10 Years	Public Health Informatics Fellow	Centers for Disease Control and Prevention	GA
Suzanna Lopez Arnone	PharmD	23 Years	Informatics Pharmacist, Sr Consultant Pharmacy Technology	Cardinal Health	CA

Tanya Ezekiel	PharmD, BCPS	19 Years	Clinical Informatics and Formulary Standardization Pharmacist	Prisma Health	SC
Theresa Braun	PharmD	13 Years	Clinical Decision Support Pharmacist	Premier Health	OH
Trinh Le	MBA, FASHP	25 Years	Chief Pharmacy Informatics Officer	Mayo Clinic	MN
Tyler Alexander Vest	PharmD, MS, BCPS, FNCAP	7 Years	Associate Chief Pharmacy Officer	Duke University Health System	NC
Zaid Yousif	PharmD, MAS	5 Years	Assistant Clinical Professor	University of California, San Diego	CA

Job Analysis



Job Analysis

A job analysis is often called a role delineation study or practice analysis in healthcare certification settings

The key points of inquiry in a Job Analysis are:

- ✓ **Definition of Target Population**
- ✓ **Tasks Performed**
- ✓ **Competencies Required**

The outcome is an exam content outline, which is used for creation of exams that reflect current practice and to identify to other stakeholders the scope of the exam



Multi-Method Approach

Both quantitative and qualitative methods are used in an RDS, which helps bolster the defensibility of the process and outcomes



Here is what the process looks like in sequence



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Multiple Levels of Analysis

Consider how you would describe a job role to someone

All three levels help define the scope

But only the outer layer is the level at which an examinee is assessed



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Exam Content Outline

An ECO is a grouping of examination content areas in a hierarchical list

Exam Content Outline Structure and Components		(Somewhat Silly) Example	
1	Content Domain	Chocolate	Domains The Major Aspects of Practice Area
1A	Content Subdomain	History	
1A1	Knowledge Area	Mesoamerican Usage	Meaningful Divisions within the Domain
1A2	Knowledge Area	European Adaptation	
1A3	Knowledge Area	Modern Production	
1B	Content Subdomain	Types	The Knowledge Assessed by Exam Items Each of these should be written such that they can be preceded by the phrase "Knowledge of"
1B1	Knowledge Area	Milk Chocolate	
1B2	Knowledge Area	Dark Chocolate	
1B3	Knowledge Area	White Chocolate	

Context Is Key



In addition to creation of an ECO, we will develop an inventory of task statements.

- These tasks identify the objectives and responsibilities of the role.
- These tasks provide the context in which the knowledge is applied.
- Tasks need not be grouped into content domains.
- Tasks will not be used to classify exam items nor determine what is tested.

Linkage Analysis

A linkage matrix looks something like this

Purpose of the Linkage Matrix

- demonstrate which knowledge areas are required for each task
- demonstrate that the knowledge areas are indeed practice-based
- help identify gaps in either inventory
- help identify tasks or knowledge that are superfluous or out-of-scope

	1	2	3	4	5	6	7	8	9
1A1						x		x	
1A2					x				
1A3				x					x
1B1			x	x					
1B2			x				x		
1C1	x	x							
1C2		x					x		x

Helpful Hints

- An x-mark means that the specific knowledge is needed to perform that specific task.
- For example, knowledge of different types of chocolate is needed to *Develop Chocolate Recipes* but history of chocolate is not needed for that same task.

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Confidentiality



Although the outcomes of the Job Analysis will eventually be summarized in a public-facing document, please do not disclose information about our deliberations or work in progress



Any information other than that provided by BPS can give an unfair advantage or disadvantage to examinees, thereby threatening the validity of the exam



When asked about your involvement, simply direct prospective examinees and other stakeholders to official channels (BPS website) for information about the certification program

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Appendix C – Survey Text



BPS 2023 Pharmacy Informatics Job Analysis Survey Survey Introduction

The Board of Pharmacy Specialties (BPS) is conducting a job analysis to determine the scope of the knowledge and skills required and tasks performed by an informatics pharmacist and explore whether to establish a specialty certification program for pharmacy informatics.

As part of this job analysis, we request the participation of pharmacists specializing in pharmacy informatics to complete this survey, providing ratings and feedback for tasks and knowledge areas representing current practice in pharmacy informatics, as identified by a panel of informatics pharmacists.

Survey respondents will be prompted to rate each task and knowledge area on its importance to pharmacy informatics and its frequency of performance/use.

Additionally, respondents will be asked a few demographic questions to better understand the respondent sample's professional qualifications - but no personally identifiable information will be solicited.

Responses will only be reviewed in aggregate and will not be used for any other purpose than the job analysis.

Your participation is expected to take 15 to 30 minutes in total.

Those who complete the survey are eligible for entry into a raffle for one of ten \$25 Amazon gift cards.

If you have any questions about this survey, please feel free to contact ja@aphanet.org.

Are you willing to participate in this survey and provide your responses to BPS?

☐ Yes

☐ No

BPS 2023 Pharmacy Informatics Job Analysis Survey

Task Statements

Please rate each task statement according to its importance to pharmacy informatics and the frequency of its performance in pharmacy informatics.

	Importance	Frequency
Design and develop health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders		
Evaluate and procure health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders		
Implement and integrate health information technology, systems, and workflows in collaboration with information technology		

professionals, healthcare professionals, and other relevant stakeholders		
Maintain, support, and optimize health information technology, systems, and workflows in collaboration with information technology professionals, healthcare professionals, and other relevant stakeholders		
Conduct needs assessment and determine applicability of available information technologies to pharmacy practice, education, administration, and research		
Configure and maintain databases to ensure the integrity, usability, and access of the data		
Perform data analysis, visualization, interpretation, and reporting related to clinical services, medication-use process, pharmacy operations, and patient outcomes		
Evaluate financial integrity related to the medication-use process across the continuum of care		

Design, implement, and evaluate clinical decision support used in the medication-use process across the continuum of care

Develop policies, procedures, and training materials for the utilization of health information technology, systems, and workflows

Ensure compliance with legal and regulatory requirements as well as standards and best practices in healthcare and information technology

Design, implement, and evaluate business continuity procedures, including downtime preparedness, redundancy, and system recovery

Develop and provide education and training to healthcare professionals, information technology professionals, and learners about pharmacy informatics

Lead and/or participate in governance, change management, project management, and process

improvement
associated with
health
information
technology,
systems, and
workflows

Engage in
continuous
professional
development in
pharmacy
informatics, such
as committee
involvement,
scholarly
activities, and
continuing
education

What task associated with pharmacy informatics is missing from this list, if any?

BPS 2023 Pharmacy Informatics Job Analysis Survey

Knowledge Areas

Please rate each knowledge area in the Clinical Workflow: Software Applications content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Ordering and Prescribing Functions (e.g., CPOE, e-prescribe, real-time prescription benefits, electronic prior authorization)		
Verification Functions (e.g., auto-verification, dual-verification, product selection, formulary management)		
Preparation and Compounding Functions (e.g., batch preparation, patient-specific preparation, IV workflow technology, repackaging)		
Dispensing and Distribution Functions (e.g., equivalency mapping, dispensing hierarchy/logic, medication-fill automation,		

diversion prevention)		
Administration Functions (e.g., BCMA, MAR, standardization of routes and frequencies, smart pump library management)		
Monitoring Functions (e.g., PDMP, adverse event reporting, medication adherence, REMS, registries, immunizations, MTM)		
Inventory Management Functions (e.g., persistent inventory, procurement, medication tracking, drug shortage and recall management)		
Documentation and Communication Functions (e.g., documentation templates, clinic notes, messaging, care coordination, patient education, patient-facing EHR)		
Transitions of Care Functions (e.g., medication reconciliation, external order history, prior authorization)		

Please rate each knowledge area in the Clinical Workflow: Clinical Decision Support content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Five Rights of Clinical Decision Support		
Active Clinical Decision Support (e.g., FSV, custom alerts, medication warnings, alert fatigue)		
Passive Clinical Decision Support (e.g., defaults, pathways, order sets, templates, reminders, guidelines, dashboards)		
Clinical Patient Monitoring (e.g., medication stewardship, acuity/prioritization, pharmacogenomics and precision medicine)		
Advanced Decision Support (e.g., probability modeling)		
Medication Safety Best Practices (e.g., ISMP, TJC, CMS, leapfrog)		

Please rate each knowledge area in the Operational Workflow: Health Information Technology content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Ordering and Verification Technology (e.g., computers, document scanners, security tokens, smartphones)		
Preparation and Compounding Technology (e.g., compounders, repackagers, robotics, scales, cameras)		
Dispensing and Distribution Technology (e.g., conveyor belts, pill counters, robotic delivery, kits/trays/carts, tube systems, cabinets, medication tracking)		
Administration Technology (e.g., smart pumps, barcode scanners, reminders)		
Monitoring Technology (e.g., telemetry, telehealth, app-integrated technology, wearable devices, digiceuticals)		
Inventory Management Technology (e.g., point-of-sale systems, carousels, refrigerators, printers, asset tagging, RFID)		

Please rate each knowledge area in the Operational Workflow: System Build content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Medication Build and Maintenance (e.g., drug database updates, vendor updates, research protocols, investigational drugs)		
System Build and Maintenance (e.g., UI/UX, GUI, code upgrades, user support, issue management, downtime procedures)		
System Implementation and Evaluation (e.g., service and product procurement, vendor management, SDLC)		
System and Device Integration (e.g., API, external systems)		
Interoperability Standards (e.g., standardized medication profile, pharmacist eCare plan, HIE)		
Coding Standards (e.g., NDC, RxNorm, SNOMED CT, LOINC, CPT, ICD10/11, HL7, NCPDP)		

Please rate each knowledge area in the Operational Workflow: System Operation content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Financial Integration (e.g., 340B, X12, claims, adjudication, drug pricing, revenue integrity, COA vs. COD, cost transparency)		
Project and Workflow Management (e.g., Gantt, Vizio, critical path, PDSA, KPIs, budgeting, resources)		
Change Management (e.g., training, system adoption, release scheduling, testing methods)		
Quality Management and Process Improvement (e.g., root cause analysis, troubleshooting, data collection)		
Governance (e.g., risk management, policies and procedures, business continuity, system security, user access)		
Legal and Regulatory Requirements (e.g., HIPAA, HITECH act, 21st century cures act, DEA)		

Please rate each knowledge area in the Data and Information Management: Data Structure content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Data Models (e.g., entity relationship model, relational and non-relational databases, hierarchical model)		
Logic Concepts (e.g., if, or, xor, and, then, Boolean, case statements)		
Data Types (e.g., quantitative, qualitative, structured, unstructured, free text, discrete, continuous)		
Data Governance (e.g., ethics, data integrity, data security, privacy)		
Referential Compendia (e.g., drug information databases)		

Please rate each knowledge area in the Data and Information Management: Data Analytics content domain according to its importance to pharmacy informatics and the frequency of its use in pharmacy informatics.

	Importance	Frequency
Analytics Tools (e.g., MS excel, R, SQL, Python)		
Statistical Analysis and Research Methods		
Data Storage (e.g., disparate data sources, warehouses, cloud storage, data lake)		
Data Preparation and Cleaning		
Data Analysis and Interpretation (e.g., prescriptive vs. descriptive, forecasting, predictive analytics)		
Data Reporting and Visualization (e.g., audience analysis, dashboards, charts, graphs, data storytelling, automated reporting)		
Machine Learning and Artificial Intelligence		

What knowledge area associated with pharmacy informatics is missing from this list, if any?

BPS 2023 Pharmacy Informatics Job Analysis Survey

Survey Respondent Demographics

What percentage of your professional practice is spent in pharmacy informatics?

Which post-graduate pharmacy residency programs have you completed? Select all that apply and leave blank if none.

- ☐ PGY1 Pharmacy
- ☐ PGY1 Managed Care Pharmacy
- ☐ PGY1 Community-Based Pharmacy
- ☐ PGY2 Ambulatory Care Pharmacy
- ☐ PGY2 Cardiology Pharmacy
- ☐ PGY2 Clinical Pharmacogenomics
- ☐ PGY2 Community-Based Pharmacy Administration and Leadership
- ☐ PGY2 Corporate Pharmacy Administration and Leadership
- ☐ PGY2 Critical Care Pharmacy
- ☐ PGY2 Emergency Medicine Pharmacy
- ☐ PGY2 Geriatric Pharmacy
- ☐ PGY2 Health System Pharmacy Administration and Leadership
- ☐ PGY2 Infectious Diseases Pharmacy
- ☐ PGY2 Internal Medicine Pharmacy

- ☐ PGY2 Investigational Drugs and Research
- ☐ PGY2 Medication Use Safety and Policy
- ☐ PGY2 Neurology
- ☐ PGY2 Oncology Pharmacy
- ☐ PGY2 Palliative Care / Pain Management Pharmacy
- ☐ PGY2 Pediatric Pharmacy
- ☐ PGY2 Pharmacotherapy
- ☐ PGY2 Pharmacy Informatics
- ☐ PGY2 Population Health Management and Data Analytics Pharmacy
- ☐ PGY2 Psychiatric Pharmacy
- ☐ PGY2 Solid Organ Transplant Pharmacy
- ☐ PGY2 Specialty Pharmacy Administration and Leadership
- ☐ Other: please specify

Which BPS certifications do you currently hold? Select all that apply and leave blank if none.

- ☐ BCACP - Ambulatory Care
- ☐ BCCCP - Critical Care
- ☐ BCCP - Cardiology
- ☐ BCEMP - Emergency Medicine
- ☐ BCGP - Geriatric
- ☐ BCIDP - Infectious Diseases
- ☐ BCNP - Nuclear
- ☐ BCNSP- Nutrition Support
- ☐ BCOP - Oncology
- ☐ BCPP - Psychiatric
- ☐ BCPPS - Pediatric
- ☐ BCPS - Pharmacotherapy
- ☐ BCSCP - Compounded Sterile Preparations
- ☐ BCTXP - Solid Organ Transplantation

Which certifications related to pharmacy informatics not issued by BPS do you currently hold? Select all that apply and leave blank if none.

- ☐ AMIA Certified Health Informatics Professional (ACHIP)
- ☐ ASHIM Certified Health Informatics System Professional (CHISP)
- ☐ CSSC Lean Six Sigma Black Belt
- ☐ HIMSS Certified Associate in Healthcare Information and Management Systems (CAHIMS)
- ☐ HIMSS Certified Professional in Healthcare Information and Management Systems (CPHIMS)
- ☐ PMI Project Management Professional (PMP)
- ☐ Scrum Alliance Certified Scrum Product Owner (CSPO)
- ☐ Scrum Alliance Certified ScrumMaster (CSM)
- ☐ Other (please specify)

How many years of experience do you have as a pharmacist?

How many years of experience do you have in pharmacy informatics?

What is your primary practice setting?

- ☐ Academic Institution / Educational Institution
- ☐ Academic Medical Center or Hospital
- ☐ Children's Hospital
- ☐ Community Hospital
- ☐ Community Pharmacy
- ☐ Home Infusion / Ambulatory Infusion
- ☐ Hospice
- ☐ Hybrid Academic-Community Hospital
- ☐ Integrated Health System / Accountable Care Organization
- ☐ Investigational Drug Service
- ☐ Long-Term Care Pharmacy
- ☐ Managed Care
- ☐ Outpatient Clinic / Ambulatory Clinic
- ☐ Pharmaceutical Industry
- ☐ Specialty Pharmacy
- ☐ Governmental Healthcare Facility / Veterans Affairs Hospital
- ☐ Other (please specify)

Where is your primary practice located?

State or Territory (if in United States)

-- select state --

Nation/Country

What percentage of your time do you spend in each area?

Direct Patient Care

System & Technology Support

Administration / Management

Teaching / Precepting

Research / Scholarship

Other



BPS 2023 Pharmacy Informatics Job Analysis Survey

Thank You

Please provide any feedback or comments about the survey here.

Those who complete the survey are eligible for entry into a raffle for one of ten \$25 Amazon gift cards. If you would like to be entered into the raffle, please enter your email address below. Your email address will be used for the sole purpose of sending your gift card if you win.

Thank you very much for your interest and participation!

Appendix D – Exam Content Outline

1	Clinical Workflow	42%
1A	Software Applications	26%
1A1	Ordering and Prescribing Functions (e.g., CPOE, e-prescribe, real-time prescription benefits, electronic prior authorization)	
1A2	Verification Functions (e.g., auto-verification, dual-verification, product selection, formulary management)	
1A3	Preparation and Compounding Functions (e.g., batch preparation, patient-specific preparation, IV workflow technology, repackaging)	
1A4	Dispensing and Distribution Functions (e.g., equivalency mapping, dispensing hierarchy/logic, medication-fill automation, diversion prevention)	
1A5	Administration Functions (e.g., BCMA, MAR, standardization of routes and frequencies, smart pump library management)	
1A6	Monitoring Functions (e.g., PDMP, adverse event reporting, medication adherence, REMS, registries, immunizations, MTM)	
1A7	Inventory Management Functions (e.g., persistent inventory, procurement, medication tracking, drug shortage and recall management)	
1A8	Documentation and Communication Functions (e.g., documentation templates, clinic notes, messaging, care coordination, patient education, patient-facing EHR)	
1A9	Transitions of Care Functions (e.g., medication reconciliation, external order history, prior authorization)	
1B	Clinical Decision Support	16%
1B1	Five Rights of Clinical Decision Support	
1B2	Active Clinical Decision Support (e.g., FSV, custom alerts, medication warnings, alert fatigue)	
1B3	Passive Clinical Decision Support (e.g., defaults, pathways, order sets, templates, reminders, guidelines, dashboards)	
1B4	Clinical Patient Monitoring (e.g., medication stewardship, acuity/prioritization, pharmacogenomics and precision medicine)	
1B5	Advanced Decision Support (e.g., probability modeling)	
1B6	Medication Safety Best Practices (e.g., ISMP, TJC, CMS, leapfrog)	
2	Operational Workflow	39%
2A	Health Information Technology	11%
2A1	Ordering and Verification Technology (e.g., computers, document scanners, security tokens, smartphones)	
2A2	Preparation and Compounding Technology (e.g., compounders, repackagers, robotics, scales, cameras)	
2A3	Dispensing and Distribution Technology (e.g., conveyor belts, pill counters, robotic delivery, kits/trays/carts, tube systems, cabinets, medication tracking)	
2A4	Administration and Monitoring Technology (e.g., smart pumps, barcode scanners, reminders, app-integrated technology, wearable devices, digiceuticals)	
2A5	Inventory Management Technology (e.g., point-of-sale systems, carousels, refrigerators, printers, asset tagging, RFID)	

2B	System Build	14%
2B1	Medication Build and Maintenance (e.g., drug database updates, vendor updates, research protocols, investigational drugs)	
2B2	System Build and Maintenance (e.g., UI/UX, GUI, code upgrades, user support, issue management, downtime procedures)	
2B3	System Implementation and Evaluation (e.g., service and product procurement, vendor management, SDLC)	
2B4	System and Device Integration (e.g., API, external systems)	
2B5	Interoperability Standards (e.g., standardized medication profile, pharmacist eCare plan, HIE)	
2B6	Coding Standards (e.g., NDC, RxNorm, SNOMED CT, LOINC, CPT, ICD10/11, HL7, NCPDP)	
2C	System Operation	14%
2C1	Financial Integration (e.g., 340B, X12, claims, adjudication, drug pricing, revenue integrity, COA vs. COD, cost transparency)	
2C2	Project and Workflow Management (e.g., Gantt, Visio, critical path, PDSA, KPIs, budgeting, resources)	
2C3	Change Management (e.g., training, system adoption, release scheduling, testing methods)	
2C4	Quality Management and Process Improvement (e.g., root cause analysis, troubleshooting, data collection)	
2C5	Governance (e.g., risk management, policies and procedures, business continuity, system security, user access)	
2C6	Legal and Regulatory Requirements (e.g., HIPAA, HITECH act, 21st century cures act, DEA)	
3	Data and Information Management	19%
3A	Data Structure	10%
3A1	Data Models (e.g., entity relationship model, relational and non-relational databases, hierarchical model)	
3A2	Logic Concepts (e.g., if, or, xor, and, then, Boolean, case statements)	
3A3	Data Types (e.g., quantitative, qualitative, structured, unstructured, free text, discrete, continuous)	
3A4	Data Governance (e.g., ethics, data integrity, data security, privacy)	
3A5	Referential Compendia (e.g., drug information databases)	
3B	Data Analytics	9%
3B1	Analytics Tools (e.g., MS Excel, R, SQL, Python, ML/AI)	
3B2	Statistical Analysis and Research Methods	
3B3	Data Storage, Preparation, and Cleaning	
3B4	Data Analysis and Interpretation (e.g., prescriptive vs. descriptive, forecasting, predictive analytics)	
3B5	Data Reporting and Visualization (e.g., audience analysis, dashboards, charts, graphs, data storytelling, automated reporting)	