

# The Clinical Informatics Milestone Project

*A Joint Initiative of*

The Accreditation Council for Graduate Medical Education

The American Board of Anesthesiology

The American Board of Emergency Medicine

The American Board of Family Medicine

The American Board of Genetics and Genomics

The American Board of Internal Medicine

The American Board of Pathology

The American Board of Pediatrics

The American Board of Preventive Medicine

The American Board of Radiology



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The Milestones are designed only for use in evaluation of the fellow in the context of their participation in ACGME-accredited residency or fellowship programs. The Milestones provide a framework for assessment of the development of the fellow in key dimensions of the elements of physician competency in a specialty or subspecialty. They neither represent the entirety of the dimensions of the six domains of physician competency, nor are they designed to be relevant in any other context.

## **Clinical Informatics Milestones**

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## Milestone Reporting

This document presents Milestones designed for programs to use in semi-annual review of fellow performance and reporting to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME competencies organized in a developmental framework from less to more advanced. They are descriptors and targets for fellow performance as a fellow moves from entry into fellowship through graduation. In the initial years of implementation, the Review Committee will examine Milestone performance data for each program's fellows as one element in the Next Accreditation System (NAS) to determine whether fellows overall are progressing.

For each period, review and reporting will involve selecting milestone levels that best describe a fellow's current performance and attributes. Milestones are arranged into numbered levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert in the subspecialty.

Selection of a level implies that the fellow substantially demonstrates the milestones in that level, as well as those in lower levels (see the diagram on page v).

**Level 1:** The fellow demonstrates milestones expected of an incoming fellow.

**Level 2:** The fellow is advancing and demonstrates additional milestones, but is not yet performing at a mid-fellowship level.

**Level 3:** The fellow continues to advance and demonstrate additional milestones, consistently including the majority of milestones targeted for fellowship.

**Level 4:** The fellow has advanced so that he or she now substantially demonstrates the milestones targeted for fellowship. This level is designed as the graduation target.

**Level 5:** The fellow has advanced beyond performance targets set for fellowship and is demonstrating "aspirational" goals which might describe the performance of someone who has been in practice for several years. It is expected that only a few exceptional fellows will reach this level.

## **Additional Notes**

Level 4 is designed as the graduation *target* and *does not* represent a graduation *requirement*. Making decisions about readiness for graduation is the purview of the fellowship program director. Study of Milestone performance data will be required before the ACGME and its partners will be able to determine whether milestones in the first four levels appropriately represent the developmental framework, and whether Milestone data are of sufficient quality to be used for high-stakes decisions.

Examples are provided with some milestones. Please note that the examples are not the required element or outcome; they are provided as a way to share the intent of the element.

Some milestone descriptions include statements about performing independently. These activities must occur in conformity to the ACGME supervision guidelines, as well as institutional and program policies. For example, a fellow who performs a procedure independently must, at a minimum, be supervised through oversight.

*Answers to Frequently Asked Questions about Milestones are available on the Milestones web page:*  
<http://www.acgme.org/acgmeweb/Portals/0/MilestonesFAQ.pdf>.

The diagram below presents an example set of milestones for one sub-competency in the same format as the ACGME Report Worksheet. For each reporting period, a fellow's performance on the milestones for each sub-competency will be indicated by selecting the level of milestones that best describes that fellow's performance in relation to those milestones.

SBP1: Patient Safety and Unintended Consequences				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes that clinical information systems affect patient safety	Demonstrates knowledge of how clinical information systems can improve patient safety (e.g., CPOE)	Identifies improvements to patient safety utilizing information systems	Participates in informatics solutions to improve patient safety	Designs and implements solutions to improve patient safety
Recognizes the informatics issues that can result in negative consequences (e.g., problems with patient identification and matching)	Demonstrates knowledge of the etiology of negative consequences of clinical information systems	Identifies potential unintended consequences of information systems and process implementation	Participates in informatics solutions to address negative consequences	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:				Not yet achieved Level 1 <input type="checkbox"/>

Selecting a response box in the middle of a level implies that milestones in that level and in lower levels have been substantially demonstrated.

Selecting a response box on the line in between levels indicates that milestones in lower levels have been substantially demonstrated as well as **some** milestones in the higher level(s).

Patient Care 1: Technology Assessment				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates knowledge of the value of new technology	Recognizes the need for a process in implementing new technology  Describes the cost-benefit analysis process for new technology	Describes the process of implementing new technology  Participates in a cost-benefit analysis for new technology	Participates in new clinical informatics systems selection, implementation, and validation  Defends purchasing decisions to peers	Acts as primary assessor for new technology, and leads efforts for system selection
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Patient Care 2: Clinical Decision Support Systems				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes the role of clinical decision support to improve patient care	Identifies basic principles of effective clinical decision support	Participates in the implementation and deployment of a clinical decision support intervention	Evaluates (measures and analyzes) the impact of a clinical decision support intervention	Develops and implements a clinical decision support tool and demonstrates the impact on quality, safety, and cost
Recognizes the elements of clinical decision making	Identifies the principles of decision science as related to clinical decision making	Interprets computer-based representation of a clinical rule (e.g., basic Arden syntax)	Performs calculations related to decision analysis (e.g., sensitivity, specificity, utility)	
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>



Patient Care 3: Impact of Clinical Informatics on Patient Care				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes that clinical informatics tools directly impact patient care	Utilizes informatics tools to coordinate and document key events in patient care	Evaluates clinical informatics systems used in documentation and coordination of patient care (e.g., usability, effectiveness)	Participates in improving the clinical informatics systems used in documentation and coordination of patient care	Leads change in improving the clinical informatics systems used in documentation and coordination of patient care
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Patient Care 4: Project Management				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes the importance of project management in the successful execution of informatics projects	Identifies resources and tools for projects  Describes basic project management principles	Applies basic project management principles and tools	Manages project expectations of end-users and leadership while balancing competing priorities  Monitors project scope and prevents or addresses uncontrolled changes or continuous growth in project scope	Manages a project from initiation to completion, including monitoring and appropriately adjusting budget and timeline as needed
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Patient Care 5: Information System Lifecycle				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes that informatics systems need to be implemented, maintained, improved, and retired	Identifies all stages of a systems lifecycle	Participates in a system evaluation and the assessment of need for new systems  Participates in staging, prototyping, and testing a new system and in retiring existing systems	Participates in projecting and budgeting total costs of implementation, including purchasing, upgrading, training, and (when possible) retiring a system	Assesses and improves the outcomes of the implementation of a new information system
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Patient Care 6: Assessing User Needs				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes user needs and their importance in the design and implementation of systems	States the methods of assessing user needs in regards to systems workflow and information management  Describes usability frameworks and human interface design standards	Participates in the development of a requirements document  Applies usability frameworks and human interface design standards	Participates in risk assessment and mitigation (e.g., Failure Mode and Effects Analysis)	Improves user experience within an existing system
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Medical Knowledge 1: Clinical Informatics Fundamentals and Programming				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates fundamental knowledge of components and usage of information systems (e.g., network, Internet, hardware, software)	<p>Demonstrates fundamental knowledge of components and usage of health care information systems (e.g., Electronic Health Record [EHR], Lab Information System [LIS], Computerized Provider Order Entry [CPOE])</p> <p>Demonstrates basic knowledge of programming</p> <p>Demonstrates basic knowledge of databases</p> <p>Demonstrates basic knowledge of informatics standards and terminologies</p>	<p>Demonstrates basic knowledge of enterprise-wide system architecture and integration</p> <p>Converts a simple algorithm as a program or pseudo code</p> <p>Demonstrates knowledge of the different architecture of databases</p> <p>Describes the components and architecture of a data interchange standard (e.g., HL7)</p>	<p>Converts a complex algorithm into a program or pseudo code</p> <p>Creates a simple relational database</p> <p>Interprets the contents of a health care data interchange standard message</p>	<p>Demonstrates competence in the identification of changes needed in system architecture to optimize operational effectiveness</p> <p>Independently designs and programs systems</p> <p>Queries and explores complex enterprise databases such as an enterprise data warehouse (EDW)</p>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Medical Knowledge 2: Leadership and Change Management				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates knowledge of the need for leadership and effective management in health care systems  Demonstrates knowledge for effective change management in health system intervention	Recognizes the different leadership models and their value  Recognizes the components of organizational governance (e.g., processes, responsibility vs. authority)  Recognizes change management theory and strategies	Demonstrates skills for effective leadership  Recognizes the elements of effective management (e.g., conflict resolution)  Assesses organizational culture and readiness for change	Participates in an organizational leadership group/committee  Applies leadership skills to effect a clinical informatics initiative  Participates in clinical informatics process using change management theory	Leads an organizational leadership group/committee  Develops effective strategies for promoting adoption/optimization of clinical information systems
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Systems-based Practice 1: Patient Safety and Unintended Consequences				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes that clinical information systems affect patient safety  Recognizes the informatics issues that can result in negative consequences (e.g., problems with patient identification and matching)	Demonstrates knowledge of how clinical information systems (e.g., computerized physician order entry [CPOE]) can improve patient safety  Demonstrates knowledge of the etiology of negative consequences of clinical information systems	Identifies improvements to patient safety utilizing information systems  Identifies potential unintended consequences of information systems and process implementation	Participates in informatics solutions to improve patient safety  Participates in informatics solutions to address negative consequence(s) of using a clinical information system	Designs, implements, and analyzes impact of solutions to improve patient safety
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Systems-based Practice 2: Resource Utilization				
Level 1	Level 2	Level 3	Level 4	Level 5
<p>Interprets an organizational chart and is aware of employment contracts and benefits</p> <p>Describes the basics and purposes of budgets</p>	<p>Knows the personnel and lines of reporting in the organization</p> <p>Recognizes different budget types (e.g., capital, operating budgets)</p> <p>Demonstrates knowledge of the basics of practice finance (e.g., Part A and Part B, Centers for Medicare &amp; Medicaid Services [CMS])</p> <p>Demonstrates basic knowledge of contracting and negotiation</p>	<p>Describes the process of personnel management and employment laws (e.g., interview questions, Family and Medical Leave Act, termination policies)</p> <p>Identifies key elements of hospital and information technology (IT) budgets</p> <p>Describes how clinical information systems can support practice finance</p> <p>Describes contracting and negotiation related to health IT purchases and consulting</p>	<p>Creates a basic job description and participates in employee interviews/performance evaluation (real or simulated)</p> <p>Participates in an IT budget cycle exercise (draft, defend, and propose logical cuts and/or additions)</p> <p>Assists in the development/maintenance of documentation tools to streamline the billing processes</p> <p>Participates in a contract negotiation</p>	<p>Manages personnel effectively</p> <p>Develops and manages an informatics budget</p>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>



Systems-based Practice 3: Workflow and Data Warehouse/Repository				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates awareness of the importance of workflow in clinical informatics  Demonstrates awareness of the need for and benefits of a data warehouse or repository	Recognizes the elements and processes of a workflow analysis  Recognizes and describes the principles of data warehousing and analysis	Participates in a workflow analysis to inform a clinical informatics solution  Performs queries of clinical data warehouses or repositories  Describes the creation and population of a data warehouse (e.g., data migration, indexing, and validation)	Devises improvements or solutions based on workflow analysis  Interprets data query results  Analyzes data for clinical, quality, safety, or research purposes	Implements an improvement or solution based on a workflow analysis  Analyzes and queries health information exchanges
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Practice-based Learning and Improvement 1: Recognition of Errors and Discrepancies — Displays attitudes, knowledge, and practices that foster improvement of patient care from study of errors and discrepancies				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes and reflects upon health system errors  Recognizes that errors in clinical informatics impact patient care  Acknowledges and takes responsibility for errors when recognized	Actively observes the identification of health system errors and the process of corrective action planning for potential solutions  Describes variations of errors and the broader impact on patient care  Recognizes limits of own knowledge	Demonstrates competence by participating in identifying health system errors and implementing potential solutions  As part of a team, participates in implementing a solution to resolve information system errors that impact patient care  Reflects upon errors in a group setting	Drafts a solution to resolve an information system error that impacts patient care  Demonstrates significant awareness of own gaps in knowledge as well as personal strengths and weaknesses	Teaches and leads in identification of health system errors and implementing potential solutions  Develops and implements a solution to resolve information system errors that impact patient care
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Practice-based Learning and Improvement 2: Scholarly Activity — Analyzes and appraises pertinent literature, applies scientific method to identify, interprets evidence-based medicine, and applies it clinically				
Level 1	Level 2	Level 3	Level 4	Level 5
Develops knowledge of the basic principles of research (i.e., demographics, institutional review board [IRB], human subjects), including how research is conducted, evaluated, and applied to patient care	Applies evidence-based medicine in presentations, such as at journal club and, as appropriate, identifies research project early in fellowship	Applies evidence-based medicine principles in presentations at local or regional meetings	Applies evidence-based medicine principles in presentations at national or international meetings and/or prepares and submits articles to peer-reviewed publications	Educates others through journal clubs or mentoring research projects  Applies for peer-reviewed funding for original research  Independently conducts original informatics research
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Professionalism 1: Professionalism — Demonstrates honesty, integrity, and ethical behavior				
Level 1	Level 2	Level 3	Level 4	Level 5
Behaves honestly and recognizes the concepts of ethical behavior, occasionally requiring guidance; seeks counsel when ethical questions arise  Recognizes the concepts of respect, compassion, and empathy with regard to patients and users of clinical systems	Acknowledges personal errors and puts the interests of patients and their families first; engages in ethical behavior  Recognizes professional responsibility for reporting personal and team errors and completes institutional reporting process  Demonstrates respect, compassion, and empathy with regard to patients and users of clinical systems	Models appropriate professional conduct without external guidance  Demonstrates respect, compassion, and empathy with regard to patients and users of clinical systems, even in difficult situations	Recognizes lapses in professionalism and provides assistance to other team members and colleagues  Promotes respect, compassion, and empathy in others with regard to patients and users of clinical systems	Models honesty, respect, compassion, and empathy, even in complex situations
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Professionalism 2: Professionalism — Demonstrates responsibility and follow-through on tasks				
Level 1	Level 2	Level 3	Level 4	Level 5
Completes assigned tasks on time	Dependably completes assigned tasks in a timely manner; assists team members when requested; respects assigned schedules	Anticipates team needs and assists as needed	Anticipates team needs and takes leadership role to independently implement solutions	Exemplifies effective, reliable management of multiple competing tasks; is source of support and guidance
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Professionalism 3: Professionalism — Gives and receives feedback				
Level 1	Level 2	Level 3	Level 4	Level 5
Receives feedback constructively	Accepts feedback constructively and modifies practice in response to feedback	Provides constructive feedback	Exemplifies giving and receiving of constructive feedback; encourages and actively seeks feedback to improve performance	Models giving and receiving of constructive feedback; encourages and actively seeks feedback to improve performance
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Professionalism 4: Professionalism — Demonstrates responsiveness and sensitivity to individuals' (e.g., patients, system users, etc.) distinct characteristics and needs				
Level 1	Level 2	Level 3	Level 4	Level 5
<p>Respects individuals' diversity and autonomy; recognizes vulnerable populations</p> <p>Recognizes impact of culture on health and health behaviors</p>	<p>Embraces diversity and respects vulnerable populations; aware of potential for bias or cultural differences to affect clinical care or diagnoses</p> <p>Displays a consistent attitude and behavior that conveys acceptance of diverse individuals and groups, including diversity in gender, age, culture, race, religion, disabilities, sexual orientation, and gender identity</p> <p>Elicits cultural factors from individuals that impact health and health behaviors in the context of the biopsychosocial model</p> <p>Identifies own cultural framework that may impact patient interactions and decision-making</p>	<p>Demonstrates cultural competency; recognizes cultural differences that may affect clinical care, diagnoses, or the design/implementation of clinical systems, and identifies and avoids biases</p> <p>Incorporates patients' beliefs, values, and cultural practices in patient care plans and clinical systems</p> <p>Identifies health inequities and social determinants of health and their impact on individual and family health</p>	<p>Exemplifies cultural competency; recognizes cultural differences and identifies and avoids biases that may affect clinical care or diagnoses</p> <p>Anticipates and develops a shared understanding of needs and desires with patients and system users; works in partnership to meet those needs</p>	<p>Models cultural competency and recognition of cultural differences that may affect clinical care or diagnoses, and works with peers to avoid biases</p> <p>Demonstrates leadership in cultural proficiency, understanding of health disparities, and social determinants of health</p> <p>Develops organizational policies and education to support the application of these principles in the practice of medicine</p>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Professionalism 5: Professionalism — Understands and practices information security and privacy				
Level 1	Level 2	Level 3	Level 4	Level 5
Demonstrates awareness of the principles of information security and privacy	Recognizes the causes and prevention of security breaches and their consequences to the individual, the system, the organization, and the society at-large	Describes the process for identification, documentation, and reporting of security breaches	Demonstrates the application of adequate privacy and security measures in clinical informatics work	Appropriately identifies, documents, and reports security breaches when they occur
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>

Interpersonal and Communication Skills 1: Effective Communications with Interprofessional Teams (e.g., with peers, consultants, nursing, ancillary professionals, and other support personnel)				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes the importance of communication strategies that enable collaboration and teamwork	Demonstrates effective communication strategies that enable collaborative work	Consistently and actively engages in collaborative communication with all members of the team	Serves as a liaison or consultant to IT professionals, administrators, and health care professionals	Role models and teaches collaborative communication with the team to enhance patient care, even in challenging settings and with conflicting team member opinions
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>



Interpersonal and Communication Skills 2: Communication with Patients and Families				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes that patients and families have different learning styles, educational competencies, and health literacy levels	Demonstrates effective strategies that enable effective communication with patients and families	Translates communication skills into the design and development of clinical information systems	Participates in the implementation/ maintenance of information systems to facilitate communication between providers and patients, families, and the public	Leads the design and implementation of information systems to facilitate communication between providers and patients, families, and the public
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<b>Comments:</b>				Not yet achieved Level 1 <input type="checkbox"/>