

# **Clinical Informatics Milestones**

The Accreditation Council for Graduate Medical Education



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The Milestones are designed only for use in evaluation of fellows in the context of their participation in ACGME-accredited residency or fellowship programs. The Milestones provide a framework for the 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**

# **Work Group**

Carrie Baker, DO, MS

Peter L. Elkin, MD

Christoph U. Lehmann, MD

Veena Lingam, MD

Kyle Marshall, MD, MBI

Helen Memoli

Michael L. Miller, MD

Vishnu Mohan, MD, MBI

Howard Silverman, MD, MS

J. Mark Tuthill, MD

Leyla Warsame, MD

## **Understanding Milestone Levels and Reporting**

This document presents the Milestones, which programs use in a semi-annual review of resident/fellow performance, and then report to the ACGME. Milestones are knowledge, skills, attitudes, and other attributes for each of the ACGME Competencies organized in a developmental framework. The narrative descriptions are targets for resident/fellow performance throughout their educational program.

Milestones are arranged into levels. Tracking from Level 1 to Level 5 is synonymous with moving from novice to expert resident/fellow in the specialty or subspecialty. For each reporting period, the Clinical Competency Committee will review the completed evaluations to select the milestone levels that best describe each learner's current performance, abilities, and attributes for each subcompetency.

These levels *do not* correspond with post-graduate year of education. Depending on previous experience, a junior resident/fellow may achieve higher levels early in the educational program just as a senior resident/fellow may be at a lower level later in the educational program. There is no predetermined timing for a fellow to attain any particular level. Residents/Fellows may also regress in achievement of their milestones. This may happen for many reasons, such as over scoring in a previous review, a disjointed experience in a particular procedure, or a significant act by the resident/fellow.

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

#### **Additional Notes**

Level 4 is designed as a graduation *goal* but *does not* represent a graduation *requirement*. Making decisions about readiness for graduation and unsupervised practice is the purview of the program director. Furthermore, Milestones 2.0 include revisions and changes that preclude using Milestones as a sole assessment in high-stakes decisions (i.e., determination of eligibility for certification or credentialing). Level 5 is designed to represent an expert resident/fellow whose achievements in a subcompetency are greater than the expectation. Milestones are primarily designed for formative, developmental purposes to support continuous quality improvement for individual learners, education programs, and the specialty. The ACGME and its partners will continue to evaluate and perform research on the Milestones to assess their impact and value.

Examples are provided for some milestones within this document. Please note: 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 ACGME supervision guidelines as described in the Program Requirements, as well as to institutional and program policies. For example, a fellow who performs a procedure independently must, at a minimum, be supervised through oversight.

A Supplemental Guide is also available to provide the intent of each subcompetency, examples for each level, assessment methods or tools, and other available resources. The Supplemental Guide, like examples contained within the Milestones, is designed only to assist the program director and Clinical Competency Committee, and is not meant to demonstrate any required element or outcome.

Additional resources are available in the Milestones section of the ACGME website. Follow the links under "What We Do" at www.acgme.org.

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.

Patient Care 2: Existing and Emerging Data Sources     Access and incorporate information from emerging data sources (e.g., imaging, bioinformatics, internet of things (IoT), patient-generated, social determinants).     Assess and prioritize the integration of data from medical devices (e.g., pumps, telemetry monitors, consumer devices) into information systems.					
Level 1	Level 2	Level 3	Level 4	Level 5	
Describes opportunities and challenges to the acquisition and use of emerging data sources	Creates a plan to analyze and develop knowledge from emerging data sources	Analyzes and develops knowledge from emerging data sources	Implements specialty- specific systems to access and incorporate emerging data sources into the EHR	Accesses and incorporates information from emerging data sources	
Describes medical device data formats, types, and architecture	Defines and electronically accesses medical device data	Extracts and analyzes data from medical devices	Assesses and prioritizes the integration of data from medical devices	Develops improvements to integration and use of medical device data	
Comments:					
Comments.		_	Not Yet C	ompleted Level 1	
Selecting a response box in the middle of a level implies that milestones in that level and in lower levels have been substantially demonstrated.			between levels ind		

Comments:

<ul> <li>Patient Care 1: Consumer Informatics Applications, Portals, and Telehealth</li> <li>Develop, implement, evaluate, and/or integrate portals and other consumer-facing health informatics applications (e.g., disease management, patient education, behavior modification)</li> <li>Participate in the design, evaluation, implementation, and/or support of telehealth and health information systems</li> </ul>				
Level 1	Level 2	Level 3	Level 4	Level 5
Discusses the basis for a consumer-facing health informatics application	Identifies a use case for a consumer-facing health informatics application and deduces required functionalities	Applies tools for a consumer-facing health informatics application	Designs a consumer- facing health informatics application prototype	Implements or leads implementation of a consumer-facing health informatics application
Describes the key components and processes of telehealth, portals, and health information systems	Identifies a use case for telehealth, portals, and health information systems and describes workflow and functionalities	Evaluates applications for telehealth, portals, and health information systems	Develops improvements to existing telehealth, portals, and health information system applications	Designs and implements telehealth, portals, and health information systems

Not Yet Completed Level 1

Not Yet Assessable

Patient Care 2: Existin	g and Emerging	g Data Sources
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- Access and incorporate information from emerging data sources (e.g., imaging, bioinformatics, internet of things (IoT), patient-generated, social determinants)
- Assess and prioritize the integration of data from medical devices (e.g., pumps, telemetry monitors, consumer devices) into information systems

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Level 1	Level 2	Level 3	Level 4	Level 5
Describes opportunities and challenges to the	Creates a plan to analyze and develop knowledge	Analyzes and develops knowledge from emerging	Implements specialty- specific systems to	Accesses and incorporates information
acquisition and use of	from emerging data	data sources	access and incorporate	from emerging data
emerging data sources	sources		emerging data sources into the electronic health record (EHR)	sources
Describes medical	Defines and electronically	Extracts, stores, and	Assesses and prioritizes	Develops improvements
device data formats, types, and architecture	accesses medical device data	analyzes data from medical devices	the integration of data from medical devices	to integration and use of medical device data
Comments:				
Not Yet Completed Level 1 Not Yet Assessable				
			Not yet As	ssessable

Medical Knowledge 1: Project Management Leverage the processes and principles of project management to facilitate the successful completion of projects				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes basic project management principles and identifies resources and tools for projects	Identifies suitable areas to apply project management tools	Designs a project, leveraging project management principles	Implements a project using project management principles	Manages a project from initiation to completion, including scope, resources, and timeline
Plans and develops a project idea	Creates and leads a team	Sets deadlines and monitors project progress according to the project plan	Addresses and solves problems	Successfully manages customer expectations and evaluates projects
Comments:  Not Yet Completed Level 1  Not Yet Assessable				

# Medical Knowledge 2: Health Information Technology (HIT) Knowledge of Current and New Testing, Implementation, and Monitoring

- Plan and/or participate in HIT implementations and upgrades
- Implement, integrate, monitor, evaluate, and maintain EHR and/or applied HIT systems, in collaboration with Information Technology (IT) staff members, based on clinical expertise and best practice to support optimum clinical workflow

Level 1	Level 2	Level 3	Level 4	Level 5
Discusses the features and functionalities of EHRs and other clinical information systems	Conducts requirement specifications	Participates in the system selection process using shared principles for the selection	Participates in leadership of the project group	Leads project groups in the design, implementation, and upgrade of EHRs and other clinical information systems
Possesses basic knowledge of HIT systems and their integration into the enterprise	Defines best practices for EHR implementation and maintenance	Collaborates with members of an interprofessional clinical informatics team to implement, integrate, monitor, or evaluate the EHR or other clinical information systems	Demonstrates leadership skills during implementation projects	Leads the evaluation a of clinical informatics project related to EHRs and other clinical information systems
Demonstrates basic knowledge of HIT industry standards and ontologies	Identifies and maintains stakeholder expectations	Designs and implements solutions	Evaluates projects and provides solutions	Provides knowledge management to existing solutions
Comments:  Not Yet Completed Level 1  Not Yet Assessable				

Systems-Based Practice 1: HIT Knowledge of Current and New Testing, Implementation, Monitoring  Maintain awareness of health care and IT landscapes, including available products, innovation strategies, emerging technologies, and legal and regulatory requirements to design technical solutions to enterprise challenges				
Level 1	Level 2	Level 3	Level 4	Level 5
Describes the significance of legal and regulatory issues related to technical solutions to enterprise challenges	Identifies key factors associated with legal and regulatory issues related to technical solutions to enterprise challenges	Participates in identifying legal and regulatory issues related to technical solutions to enterprise challenges	Addresses legal and regulatory issues related to technical solutions to enterprise challenges and assures compliance with regulations	Leads processes addressing legal and regulatory issues related to technical solutions to enterprise challenges
Discusses the role of vendor HIT products, emerging technologies, and innovation	Identifies opportunities for the use of vendor HIT products, emerging technologies, and innovation	Analyzes HIT products, emerging technologies, and innovation for one or more specific opportunities	Participates meaningfully in selection and implementation of HIT products, emerging technologies, and innovation	Leads projects related to the implementation of HIT products, emerging technologies, and innovation
Comments:  Not Yet Completed Level 1				

### Systems-Based Practice 2: Standards and Interoperability

- Apply methods and standards for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms
- Reconcile requirements for clinical integration of data with technical constraints to maintain connectivity, interfacing, and validity of content between systems and clinical areas
- Advance/foster interoperability between disparate health information systems

	operability between disparate	, , , , , , , , , , , , , , , , , , ,		
Level 1	Level 2	Level 3	Level 4	Level 5
Describes methods and standards for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms	Analyzes key factors regarding methods and standards for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms	Identifies opportunities for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms	Participates in efforts to design and implement methods and standards for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms	Leads efforts to design and implement methods and standards for data sharing across systems to support data sharing through health information exchanges, public health reporting, or other mechanisms
Discusses issues related to ensuring connectivity, interfacing, and validity of content between systems and clinical areas	Identifies requirements and/or constraints related to ensuring connectivity, interfacing, and validity of content between systems and clinical areas	Participates in efforts to ensure connectivity, interfacing, and validity of content between systems and clinical areas	Develops solutions to ensure connectivity, interfacing, and validity of content between systems and clinical areas	Implements solutions to ensure connectivity, interfacing, and validity of content between systems and clinical areas
Discusses sociocultural and other issues regarding fostering interoperability between disparate health information systems	Analyzes key factors in fostering interoperability between disparate health information systems	Identifies opportunities to foster interoperability between disparate health information systems	Participates meaningfully in efforts to foster interoperability between disparate health information systems	Leads efforts to foster interoperability between disparate health information systems
Comments:  Not Yet Completed Level 1				

## Systems-Based Practice 3: Data Integrity/Security

Develop, implement, and/or leverage data lifecycle processes for defining sources, and acquiring, storing, cleaning, and ensuring
integrity of data to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic
objectives

Participate in ongoing security threat assessments, development of clinician-facing and enterprise security policy, and reinforce

security training and policies with clinical staff members

security training and policies with clinical staff members				
Level 1	Level 2	Level 3	Level 4	Level 5
Discusses data issues and processes to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic objectives	Analyzes key factors in existing efforts to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic objectives	Identifies opportunities for implementing new processes to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic objectives	Meaningfully participates in the development of new processes to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic objectives	Leads efforts to implement processes to safeguard the availability of relevant and valid data to meet clinical, quality, research, business, and strategic objectives
Describes security threat assessments, development of security policies, and training	Recognizes key factors and benefits related to security threat assessments, development of security policies, and training	Identifies areas of focus for security threat assessments, development of security policies, and training	Meaningfully engages in efforts to conduct security threat assessments, development of security policies, and training	Educates others regarding security threat assessments, development of security policies, and training
Comments:  Not Yet Completed Level 1				

Practice-Based Learning and Improvement 1: Optimization, Downtime, Functional Requirements  Analyze and identify necessary system and process changes to optimize clinical and related workflows				
Level 1	Level 2	Level 3	Level 4	Level 5
Discusses challenges associated with clinical information system upgrades and downtime	Provides direct user support during EHR upgrades, routine system maintenance cycles, and downtime	Analyzes workflows related to clinician use of the EHR and suggests techniques for optimization of both workflows and EHR use	Develops and deploys specific system and process changes during EHR upgrades and for optimization-related clinical informatics projects	Develops and executes EHR upgrade, optimization, and downtime procedures
Articulates functional requirements related to EHR optimization and system downtime	Supports clinicians in EHR optimization and system downtime	Analyzes downtime events and identifies areas for improvement	Develops solution for downtime problems and challenges	
Comments:  Not Yet Completed Level 1				

Practice-Based Learning and Improvement 2: Clinical Decision Support (CDS)  Develop, implement, evaluate, monitor, and/or maintain clinical decision support						
Level 1	Level 1 Level 2 Level 3 Level 4 Level 5					
Identifies the elements and categories and discusses the challenges of CDS, such as alert fatigue	Describes the basics of the science of decision- making, including heuristics and tools to analyze decisions	Participates in the design and evaluation of an evidence-based CDS based on input from stakeholders	Assists in implementation of an evidence-based CDS, and monitors its effectiveness using key outcomes/measures/metrics	Leads the design and implementation of an evidence-based CDS and develops a plan to identify and monitor key outcomes/measures/metrics		
Comments:  Not Yet Completed Level 1						

<ul> <li>Practice-Based Learning and Improvement 3: Analytics</li> <li>Employ data mining and analytic techniques (including but not limited to data visualization, artificial intelligence, natural language processing, machine learning) to optimize clinical and business decision-making</li> <li>Identify, execute, interpret, and disseminate measures and/or predictive analytics to provide actionable feedback to improve individual and organizational performance</li> </ul>				
Level 1	Level 2	Level 3	Level 4	Level 5
Discusses various data mining and analytics techniques	Identifies appropriate data analytics tools and visualizations for a specific use case	Constructs queries using database query languages and ancillary software and performs preliminary analysis on datasets	Analyzes datasets using programming tools and present summary findings to stakeholders using data visualization tools	Leverages analytics to improve patient care
Comments:  Not Yet Completed Level 1				

_	and Improvement 4: Huma prove usability of user-facing	-	CI) and User Interfaces (L	JI)
Level 1	Level 2	Level 3	Level 4	Level 5
Identifies models, theories, and practices of HCI, including interface design standards and principles	Discusses the role of EHR UI in causing clinical errors	Participates in analysis of feedback of EHR users of UI as new functionalities or modules are implemented	Evaluates elements of usability of a new EHR module or functionality	Designs or modifies a prototype for UI that can be used by clinical end users
Comments:			Not Yet C	ompleted Level 1

Practice-Based Learning	and Improvement 5: Reflec	ctive Practice and Commitr	ment to Personal Growth	
Level 1	Level 2	Level 3	Level 4	Level 5
Accepts responsibility for personal and professional development by establishing goals	Demonstrates openness to performance data (feedback and other input) to inform goals	Seeks performance data episodically, with adaptability and humility	Intentionally seeks performance data consistently, with adaptability and humility	Role models consistently seeking performance data with adaptability and humility
Identifies the factors that contribute to gap(s) between expectations and actual performance	Analyzes and reflects on the factors that contribute to gap(s) between expectations and actual performance	Analyzes, reflects on, and institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance	Challenges assumptions and considers alternatives in narrowing the gap(s) between expectations and actual performance	Coaches others on reflective practice
Actively seeks opportunities to improve	Designs and implements a learning plan, with prompting	Independently creates and implements a learning plan	Uses performance data to measure the effectiveness of the learning plan and, when necessary, improves it	Facilitates the design and implementation of learning plans for others
Comments:			Not Yet C	ompleted Level 1

#### **Professionalism 1: Governance**

- Collaborate in the establishment and maintenance of data governance structures, policies, and processes that encompass data quality, integrity, security, access, data domain management, definition of clinical and business cohorts, oversight and application of data standards, data provenance/lineage, metadata, and data dictionaries/definitions
- Establish and/or participate in HIT governance to support strategic and financial planning, including formulation, implementation, and evaluation
- Identify informatics trends, best practices, and new technologies and/or participate in governance processes to position the organization for future opportunities
- Participate in the development of organizational health informatics goals, strategies, and tactics in alignment with the organizational mission and vision (using data, finance, and informatics best practices).

organizational mission and vision (doing data; inlands, and information best practices).				
Level 1	Level 2	Level 3	Level 4	Level 5
Attends and provides summaries of organizational informatics and/or management governance meetings	Adds meaningful contributions to ideas generated during (or in relation to) governance meetings	Contributes new ideas and tools to governance and leads subtasks/projects for the governance committee	Leads work that meaningfully contributes to new policies and strategic plans	Co-leads organizational HIT governance activities
Comments:			Not Yet C	ompleted Level 1

Professionalism 2: Mento Engage, educate, supervis systems, and processes	orship e, and/or mentor clinicians a	nd other health care team me	embers in their use of healt	h information tools,
Level 1	Level 2	Level 3	Level 4	Level 5
Explains the functionality of health IT systems	Provides direct support for health IT systems	Participates in the development of learning materials for HIT	Actively engages in individual and HIT systems training	Develops and executes user education workshops and sessions
Seeks out and engages with mentors	Offers support and advice to team members	Serves as a mentor to a team member or junior colleague	Advises mentees and supports them in development and evaluation of projects	Manages large teams of mentees at various stages of development and leverages more senior mentees to mentor junior ones
Comments:			Not Yet Co	ompleted Level 1

Professionalism 3: Profe	ssional Behavior and Ethic	cal Principles		
Level 1	Level 2	Level 3	Level 4	Level 5
Identifies and describes potential triggers for professionalism lapses, including cultural insensitivity	Demonstrates insight into professional behavior and cultural sensitivity in routine situations	Demonstrates professional behavior and cultural sensitivity in complex or stressful situations	Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in oneself and others	Coaches others when their behavior fails to meet professional expectations
Describes when and how to appropriately report professionalism lapses, including strategies for addressing common barriers	Takes responsibility for one's own professionalism lapses	Recognizes the need to seek help in managing and resolving complex ethical situations	Recognizes and utilizes appropriate resources for managing and resolving ethical dilemmas as needed (e.g., ethics consultations, literature	Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution
Demonstrates knowledge of the ethical principles underlying the practice of clinical informatics	Analyzes straightforward situations using ethical principles	Analyzes complex situations using ethical principles	review, risk management/legal consultation)	
Comments:			Not Yet C	ompleted Level 1

Professionalism 4: Acco	untability/Conscientiousne	ss			
Level 1	Level 2	Level 3	Level 4	Level 5	
Takes responsibility for failure to complete tasks and responsibilities, identifies potential contributing factors, and describes strategies for ensuring timely task completion in the future	Performs tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations	Performs tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations	Recognizes situations that may impact others' ability to complete tasks and responsibilities in a timely manner	Takes ownership of system outcomes	
Responds promptly to requests or reminders to complete tasks and responsibilities	Recognizes situations that may impact one's own ability to complete tasks and responsibilities in a timely manner	Proactively implements strategies to ensure that the needs of patients, teams, and systems are met	Monitors and improves strategies to ensure that the needs of patients, teams, and systems are met	Takes ownership of personal and team failures	
Comments:			Not Yet C	ompleted Level 1	

Professionalism 5: Self-Awareness and Help-Seeking				
Level 1	Level 2	Level 3	Level 4	Level 5
Recognizes the status of personal and professional well-being, with assistance	Independently recognizes the status of personal and professional well-being	With assistance, proposes a plan to optimize personal and professional well-being	Independently develops a plan to optimize personal and professional well-being	Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations
Comments:			Not Yet C	completed Level 1

This subcompetency is not intended to evaluate a fellow's well-being, but to ensure each fellow has the fundamental knowledge of factors that impact well-being, the mechanisms by which those factors impact well-being, and available resources and tools to improve well-being.

Demonstrate effect	ive communication, negotiation sensitive collaboration with he	nicate Effectively with Mult on, and conflict resolution ski ealth care team members, pa	ills	e community, external
Level 1	Level 2	Level 3	Level 4	Level 5
Effectively uses an online team communication tool	Creates a logical argument to propose a new project	Writes a project proposal that is approved by the administration	Implements the results of a project into practice	Demonstrates practice improvement through team science and team medicine
Demonstrates culturally sensitive communications	Sets up culturally sensitive communication by the team, project, and subproject	Generates a culturally sensitive project proposal that is approved by the administration	Implements a culturally sensitive project in clinical practice	Demonstrates the effectiveness of a culturally sensitive practice improvement project
Comments:			Not Yet C	ompleted Level 1

•	unication Skills 2: Building lignment for informatics best		nolders are active, visible sp	oonsors of informatics
Level 1	Level 2	Level 3	Level 4	Level 5
Identifies stakeholders	Creates targeted messaging for each stakeholder	Delivers messages to stakeholders in multi- modal fashion and receives feedback	Coordinates discussions to resolve conflict across stakeholders	Builds consensus that is operationalized in the health system
Contributes to the creation of a project vision	Communicates vision of the project	Participates in governance	Inspires and motivates others to accept change	Evaluates change and pursues opportunities for improvement
Comments:			Not Yet Co	ompleted Level 1

Level 1	Level 2	Level 3	Level 4	Level 5
Respectfully requests a consultation	Clearly and concisely requests a consultation and explains the rationale for the request	Checks one's own understanding of consultant recommendations	Coordinates recommendations from different members of the health care team to optimize patient care	Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed
Respectfully receives a consultation request	Clearly and concisely responds to a consultation request	Checks understanding of recommendations when providing consultation		oommet when needed
Uses language that values all members of the health care team	Communicates information effectively with all health care team members	Uses active listening to adapt communication style to fit team needs	Communicates feedback and constructive criticism to superiors	Facilitates regular health care team-based feedback in complex situations
	Solicits feedback on performance as a member of the health care team	Communicates concerns and provides feedback to peers and learners		

Level 1	Level 2	Level 3	Level 4	Level 5
Accurately records information in the patient record	Demonstrates organized diagnostic and therapeutic reasoning through notes in the patient record	Concisely reports diagnostic and therapeutic reasoning in the patient record	Communicates clearly, concisely, in a timely manner, and in an organized written form, including providing anticipatory guidance	Models feedback to improve others' written communication
Safeguards patient personal health information	Documents required data in formats specified by institutional policy	Appropriately selects direct (e.g., telephone, inperson) and indirect (e.g., progress notes, text messages) forms of communication based on context	Produces written or verbal communication (patient notes, email, etc.) that serves as an example for others to follow	Guides departmental or institutional communication around policies and procedures
Communicates through appropriate channels as required by institutional policy (e.g., patient safety reports, cell phone/pager usage)	Respectfully communicates concerns about the system	Uses appropriate channels to offer clear and constructive suggestions to improve the system	Initiates difficult conversations with appropriate stakeholders to improve the system	Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field)