

**Table 1** Competency domains, competencies, and developmental milestones on the MD-PhD Competency Toolkit, developed in 2022 by the MD-PhD Competencies Development Workgroup, Association of American Medical Colleges Group on Research, Education, and Training.<sup>a</sup>

Milestones		Advanced beginner	Competent	Proficient	Expert
Competency domains and competencies	Novice				
<b>Research to health</b>					
(A) Use scientific and clinical knowledge to identify gaps and unmet health needs and solve problems in both clinical and research settings	<b>Explain</b> the value of applying clinical and research knowledge to address unmet needs in clinical medicine	<b>Provide</b> examples from the literature or own experience that demonstrate how using research and clinical skills bridges knowledge gaps	<b>Apply</b> clinical and research skills to current or planned research, and during research and clinical discussions	<b>Identify</b> clinical problems to study; <b>manage</b> clinical and research efforts effectively	<b>Lead</b> research and mentor others using scientific and clinical knowledge to address unmet health needs
(B) Apply statistical and other computational methods to health observations and data to identify unmet needs and inform research design	<b>Explain</b> basic statistical and/or computational concepts in science and medicine	<b>Identify</b> statistical and/or computational analyses to use in research	<b>Apply</b> statistical and/or computational analyses to current or planned research and during research and clinical discussions	<b>Establish</b> collaborations with statistical and/or computational scientists to interpret health and other data and produce new biomedical information	<b>Construct, apply, and teach</b> logical reasoning to interpret data, draw conclusions, make decisions, and solve biomedical problems
(C) Apply principles of health equity to clinical practice and research programs aimed at eliminating inequities	<b>Recognize and discuss</b> evidence of health disparities	<b>Recognize</b> whether studies have considered appropriate populations and/or social drivers of health	<b>Design</b> studies that include appropriate populations and consider social drivers of health	<b>Conduct</b> patient care and research studies considering social drivers of health	<b>Contribute</b> to policy changes (institutional or structural) that reduce health disparities
<b>Communication skills (written and oral)</b>					
(A) Communicate scientific ideas and their application to clinical medicine to nonexpert audiences, clinicians, and scientists	<b>Follow</b> a structured format tailored to present fundamental concepts to each audience	<b>Communicate</b> fundamental concepts with few inaccuracies. <b>Recognize</b> limits of own understanding	<b>Accurately</b> communicate concepts, relationships, novel ideas, and/or findings, highlighting knowledge gaps	<b>Adapt</b> the design and communication style to the target audience to maximize engagement	<b>Coach</b> others to use the best scientific communication practices
(B) Communicate with funding agencies to leverage the expertise of physician-scientists	<b>Discuss</b> how research is funded using grants from federal, foundations, and bioindustry	<b>Develop</b> and/or submit predoctoral fellowship or grant application with mentor's guidance	<b>Participate</b> in a postdoctoral grant application and review cycle with mentor's guidance	<b>Develop</b> a funding application in response to a clinical knowledge gap with emerging independence	<b>Develop and lead</b> funded cross-disciplinary translational research programs
<b>Professional growth</b>					
(A) Navigate differences in professional norms between clinical and research settings during career transitions	<b>Describe</b> basic differences between clinical and research workplaces	<b>Navigate</b> across differences in professional norms in clinical and research settings with coaching	<b>Transition</b> between clinical and research workspaces with emerging independence	<b>Engage</b> in clinical and research duties independently while identifying strategies to maximize productivity	<b>Integrate</b> clinical and research activities in a way that maximizes complementarity and career satisfaction

(Continued)

Table 1 Continued.

Competency domains and competencies		Milestones				
		Novice	Advanced beginner	Competent	Proficient	Expert
(B) Practice lifelong learning and growth mindset habits that support long-term engagement as a physician-scientist	Describe and explore opportunities that combine research and clinical expertise	<b>Seek</b> exposure to new research and clinical ideas while engaging deeply in curiosity-driven exploration	<b>Apply</b> experiences and evidence to inform clinical and research specialty choices	<b>Integrate</b> experiences to select a career path that maximizes potential, enables discovery, and promotes individual work-life satisfaction	<b>Model</b> lifelong learning and growth mindset habits to mentor rising physician-scientists	
(C) Use a mentor network to support your individual physician-scientist career pathway	Describe importance of mentors in career development and professional growth	<b>Identify</b> research and clinical mentors and assemble a team of advisors for specific needs; <b>engage</b> effectively as a mentee	<b>Differentiate</b> between the relative strengths and opportunities that individual mentors offer	<b>Assess</b> mentoring needs to optimize the team of research and clinical mentors	<b>Adapt</b> the mentoring team to meet evolving needs and career progression	
(D) Use mentoring skills to support the physician-scientist careers of others	Define the role of mentors and mentees in clinical and research settings	<b>Explore</b> the mentor role with junior trainees in clinical and research settings	<b>Compare and contrast</b> the roles of coaches, sponsors, and mentors; <b>evaluate</b> own mentorship skills	<b>Adjust</b> mentoring style to address the needs of mentees from diverse backgrounds	<b>Function and model</b> as an inclusive coach and mentor to optimize trainee outcomes	
(E) Work in cross-disciplinary teams of clinicians, scientists, translational researchers, and other stakeholders	Describe the roles of different members of a cross-disciplinary team	<b>Work</b> effectively and collaboratively in a cross-disciplinary team	<b>Practice and reflect</b> on effective leadership skills for cross-disciplinary teams	<b>Critically</b> evaluate the roles of team members to enhance team effectiveness	<b>Assemble and lead</b> teams that are diverse, effective, and cross-disciplinary	
<b>Personal growth</b>						
(A) Manage personal signs of stress or burnout during transitions between clinical and research settings	Recognize resistance to feedback or disengagement from learning activities	<b>Plan and practice</b> strategies to promote personal wellness	<b>Accept</b> feedback and guidance to remain engaged in clinical and research activities	<b>Adapt</b> effective strategies to balance clinical and research duties during transitions	<b>Mentor</b> others about strategies to balance clinical and research duties during transitions	
(B) Practice persistence skills to remain in a career that utilizes the skills, knowledge, and attributes from the dual degree	Reluctant to ask for help and resources	<b>Practice</b> resilience and <b>ask</b> for help and access resources	<b>Recognize and manage</b> expectations of career and personal demands	<b>Articulate</b> current and future needs for career and personal goals	<b>Define</b> personal success; <b>guide</b> others to articulate needs and goals	
(C) Develop personal values and identity and professional identity as a physician-scientist	Describe the values of a physician-scientist	<b>Articulate</b> personal and professional values relating to identity as a physician-scientist	<b>Use</b> personal and professional values as a physician-scientist choosing a clinical specialty	<b>Integrate</b> personal and professional values as a physician-scientist during clinical training	<b>Model</b> personal and professional values for other physician scientists	
(D) Minimize the impact of personal biases in clinical practice and research study design	Explain how biases impact others' views	<b>Recognize</b> personal biases and explore strategies to minimize their impact	<b>Implement</b> strategies to minimize the impact of personal biases in the role of physician-scientist	<b>Advocate</b> for changes in policies and practices that perpetuate health inequities	<b>Lead</b> institutional or community efforts to change policies that perpetuate inequities	

\*Each row represents a distinct competency, and the corresponding milestone descriptions progress horizontally from left to right, reflecting increasing levels of autonomy and mastery. The milestones are intended to guide learners, mentors, and program directors in assessing growth across the continuum of physician-scientist training—from entry into an MD-PhD program (novice) through completion of training and transition to independent practice (expert). Bold text indicates the primary behavior verb for each milestone.