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Entrustable Professional Activities and Curricular Milestones for Fellowship Training in Pulmonary and Critical Care Medicine

Report of a Multisociety Working Group

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This article describes the curricular milestones and entrustable professional activities for trainees in pulmonary, critical care, or combined fellowship programs. Under the Next Accreditation System of the Accreditation Council for Graduate Medical Education (ACGME), curricular milestones compose the curriculum or learning objectives for training in these fields. Entrustable professional activities represent the outcomes of training, the activities that society and professional peers can expect fellowship graduates to be able to perform unsupervised. These curricular milestones and entrustable professional activities are the products of a consensus process from a multidisciplinary committee of medical educators representing the American College of Chest Physicians (CHEST), the American Thoracic Society, the Society of Critical Care Medicine, and the Association of Pulmonary and Critical Care Medicine Program Directors. After consensus was achieved using the Delphi process, the document was revised with input from the sponsoring societies and program directors. The resulting lists can serve as a roadmap and destination for trainees, program directors, and educators. Together with the reporting milestones, they will help mark trainees' progress in the mastery of the six ACGME core competencies of graduate medical education. CHEST 2014; 146(3):813-834

ABBREVIATIONS: ABIM = American Board of Internal Medicine; ACGME = Accreditation Council for Graduate Medical Education; APCCMPD = Association of Pulmonary and Critical Care Medicine Program Directors; CM = curricular milestone; EPA = entrustable professional activity; NAS = Next Accreditation System; PCCM = pulmonary and critical care medicine

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Internal Medicine (ABIM) are revising the processes by which training programs and trainees are evaluated. The tools for evaluation include

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reporting milestones, curricular milestones (CMs), and entrustable professional activities (EPAs). The purpose of this article is to describe the CMs and EPAs for fellowship training in pulmonary medicine, critical care medicine, and combined pulmonary and critical care medicine (PCCM) programs. CMs (also termed developmental milestones in the literature) are detailed lists of the specific components of the curriculum of a training program.[1] Operationally, they can be considered the learning objectives for fellowship. EPAs represent the final products of fellowship training, the activities that both the medical profession and the public can trust a pulmonary and/or critical care medicine physician to perform independently.[2,3] CMs and EPAs are elements in the process of measuring the effectiveness of medical training based on educational outcomes. This document does not create any new requirements for training programs. It organizes current requirements and existing curricula into a format that is congruent with the upcoming changes in program accreditation and trainee credentialing.

Background

The ACGME is responsible to the public for the accreditation of residency and fellowship training programs, whereas the ABIM is responsible for certifying the competence of individual trainees in internal medicine and its subspecialties. The ACGME is implementing what has been termed the Next Accreditation System (NAS). The NAS constitutes a comprehensive revision of the methods for accreditation of medical training programs, and of how the educational progress of individual trainees is assessed.[4,5] Thus, this aspect of the NAS represents a convergence of some of the goals of the ACGME and the ABIM.

In the NAS, the educational progress of trainees will be tracked and documented through a series of steps known as milestones. Milestones represent sets of discrete, observable, measurable behaviors that chart the progress of a trainee at all levels through increasing levels of competence, leading to independent practice. Milestones attempt to parse the somewhat abstract six core competencies of graduate medical education (medical knowledge, patient care, professionalism, interpersonal and communication skills, practice-based learning and improvement, and systems-based practice) into more concrete, quantifiable behaviors. The 22 reporting milestones (also termed subcompetencies) for internal medicine residents have been established and published, as have milestones for many of the other fields of medicine.[6-8] Implementation of the reporting milestones in residency programs began in July 2013. The ACGME requires regularly scheduled reports on the progress of residents through these 22 reporting milestones.

Reporting milestones for the subspecialties of internal medicine have also been written, with input from the ACGME, ABIM, the Alliance for Academic Internal Medicine, and the major professional societies of all internal medicine subspecialties. That project produced a single, common set of reporting milestones that will be applicable to all fellowship programs. Like the internal medicine residency milestones on which they are largely based, the reporting milestones are intended to be "context free"; that is, the behaviors they describe are not constrained to single settings, specialties, or situations, but can be interpreted in the context of specific fellowship objectives. Beginning in July 2014, fellowship programs in internal medicine, including PCCM, will be required to implement these reporting milestones for the biannual assessment of fellows.[9]

In parallel with the writing of the common set of subspecialty reporting milestones, each of the subspecialties was charged to develop specific CMs and EPAs. In contrast to the reporting milestones, the CMs and EPAs are intended to be contextually grounded in each of the subspecialties, and will specify the unique curriculum of the subspecialties. With an appropriate degree of specificity, they list what program directors and supervisors expect fellows in PCCM training programs to learn, what we expect them to be able to do upon graduation, and, by implication, what we must teach them. They are the roadmaps and the goalposts for fellowship training and should serve as field guides for program directors and the clinical teaching faculty.

Methods

To achieve consensus on these EPAs and CMs, a working group was convened in March 2013. Membership was composed of two members each from the Association of Pulmonary and Critical Care Medicine Program Directors (APCCMPD), the American College of Chest Physicians (CHEST), the Society of Critical Care Medicine, and the American Thoracic Society. In addition to having clinical expertise in their respective fields, all members had significant experience as program directors of internal medicine residency or subspecialty fellowship training programs. In addition, several members were coauthors on prior publications of curricula in PCCM[10] or were members of the Alliance for Academic Internal Medicine/ACGME/ABIM

working group that wrote the common subspecialty reporting milestones.[9]

The working group held conference calls every 2 weeks, and had an in-person meeting in September 2013. Our deliberations were based on several foundational documents: the previously published curriculum for PCCM (itself based on a systematic literature review),[10] the ACGME program requirements for PCCM fellowships,[11-13] the reporting milestones and CMs for internal medicine residency programs,[6] the EPAs for internal medicine,[3] and literature searches for other pulmonary or critical care curricula published since 2009.

The committee decided to develop separate, but overlapping, EPAs and CMs for pulmonary medicine and for critical care medicine. Combined PCCM fellowships would then use EPAs that combined both lists. The Delphi process was used to achieve consensus as follows: For the EPAs and each of the ACGME core competencies, a comprehensive list of potential CMs was compiled from the foundational documents. The lists were reviewed individually by the committee members, who were free to add to the lists based on their knowledge of the field. The lists were discussed during conference calls to eliminate obvious redundancies and gaps. These preliminary lists were then voted on by anonymous, web-based polling. Each potential CM was rated from 1 to 5, with 1 representing "definitely keep" and 5 representing "definitely eliminate." After all members had voted, CMs with an average rating of ≤ 2 were retained (consensus to retain) and those rated ≥ 4 were rejected (consensus to reject). Items with intermediate ratings were discussed on the next conference call, during which modifications to the wording could also be proposed. In some cases, important milestones that appeared to be specific or measurable examples of more global milestones were retained as bullet points within that milestone. All indeterminate items underwent one or more subsequent rounds of voting until consensus to retain all remaining items was reached. This penultimate list was then reviewed for overlap or redundancy and consistent wording between the pulmonary and critical care versions.

The committee addressed the EPAs first, because they were fewer in number and because having the final goal of training in mind would inform deliberations on the process of training. Next, we addressed the CMs that fall under the four core competencies of practice-based learning, communication, professionalism, and systems-based practice. These core competencies are the least context specific. That is, we reasoned that trainees who behave professionally, who reflect upon and improve their own practice, who communicate well, and who work well within a health-care system as residents in internal medicine are likely to do so as fellows in PCCM. Therefore, the committee felt it was not necessary to add many more detailed CMs beyond the reporting milestones list. In addition, the CMs for these four core competencies could be identical for critical care medicine and pulmonary training.

Finally, during our face-to-face meeting, the committee addressed the CMs that fell under the core competencies of medical knowledge and patient care, including procedures. These were most numerous, and most specific to the specialty. Prior published curricula for critical care and for pulmonary medicine and the ACGME program requirements served as source documents. These extensive and overlapping source curricula were modified with the following considerations:

1. Patient care and medical knowledge are fundamentally inseparable. Operationally, globally overarching topics were listed under medical knowledge, and disease- or procedure-specific topics were listed under patient care. However, the headings of both lists emphasize acquisition of the competence needed to apply medical knowledge to patient care.
2. The final lists of CMs needed to be of manageable length, yet sufficiently detailed to provide specific guidance to program directors and trainees. This requirement entailed judicious grouping or splitting. Whenever feasible, diseases were grouped into categories, including a few specific examples as bulleted points. When grouping could have resulted in insufficient emphasis on important distinct diseases, the diseases were listed separately. The criteria for including a disease as a bullet point within a disease category were that it was either a common entity of broad importance or that it could lead to serious consequences if the diagnosis were missed.
3. Procedures were listed in one of three categories: those that a trainee has to be able to perform independently (eg, bronchoscopy), those that the trainee must be able to interpret independently (eg, chest radiography), and those that the trainee needs to understand and use, but not perform or interpret independently (eg, open lung biopsy).
4. Additional CMs were written to address the program requirements and reporting milestone for scholarly activity. Scholarly activity is required for fellowship, but not for residency training.

5. The final list of medical knowledge and patient care milestones had to be congruent with the ACGME program requirements and ABIM competency requirements. Although there was considerable discussion about desirable changes to those requirements, we reasoned that program directors should not be faced with a curriculum that was inconsistent with current, published requirements.

After consensus was reached on all CMs, a draft document was written and submitted to the three sponsoring societies for comment. The document was further revised based on their suggestions. It was then circulated to all program directors of critical care, pulmonary, and combined PCCM programs for suggestions, and a final revision was approved by the sponsoring societies. This current, final document will also be submitted to the ACGME and ABIM as an informational item.

Results

Consensus on all items was achieved in three or fewer rounds of Delphi voting. Because our in-person meeting facilitated active discussion and revision, only a single round of voting was required for the medical knowledge and patient care competencies, despite their length. Our final proposed EPAs for pulmonary medicine and critical care medicine are each shown separately in Table 1. Table 2 lists the EPAs for combined programs in pulmonary and critical care. Table 3 lists the CMs for the four common core competencies that are identical for pulmonary medicine, critical care medicine, and the combined field of PCCM. Table 3 also shows their relationship to the subcompetencies of the subspecialty reporting milestones. Note that these lists are identical for pulmonary trainees and for critical care medicine trainees. In recognition of the overlap between subcompetencies, we intentionally did not link each of our CMs to specific subcompetencies. Table 4 lists the medical knowledge and patient care CMs in a similar format, separately for pulmonary training and critical care medicine training. As anticipated because of their clinical focus, there are substantial differences between critical care and pulmonary medicine for these milestones. In Table 5, we combined the patient care and medical knowledge milestones for pulmonary medicine and critical care medicine. Many of these were similar milestones, with slightly different wording for each field. In those cases, they were reworded to reflect the broader of the two versions.

Directors of training programs in straight pulmonary medicine or critical care medicine will, therefore, find their relevant EPAs and CMs listed in Tables 1, 3, and 4. Directors of combined training programs in pulmonary and critical care will use Tables 2, 3, and 5.

Discussion

Using a formal process and with input from our professional societies and program directors, we have developed a list of CMs and EPAs for pulmonary medicine and critical care medicine. These documents serve several important goals. For the public, the EPAs provide a succinct summary of what subspecialists in our field can do and specify what trainees must be able to perform independently to ensure public trust. For trainees, the EPAs serve as a set of goals and reminders of what they must achieve.[2,3] The CMs are a detailed list of expectations, the topics and skills that trainees must master to become independent practitioners.[1] CM progress is condensed and summarized into the reporting milestones and will be reported to the ACGME.[9] For the ACGME, program accreditation may be based in part on how well and consistently trainees master these milestones. Thus, these changes represent a new emphasis on how well the topics are learned (an outcome), rather than merely their inclusion in the curriculum (a process).[14] For the ABIM, board eligibility for individual trainees can now be based on more specific, concrete, and measurable levels of competence.[15,16] Finally, for program directors and educators, the CMs provide a comprehensive and uniform list of curricular content for fellowship training, a guide for evaluation of and feedback for trainees, and the database underlying the reporting milestones.

Although the final CMs are extensive, it is neither necessary nor expected that all fellows be assessed on all the numerous CMs. For example, consider the relationship between curricular content for a course and the course's final examination. Content may be extensive, but need not all be on the final examination to grade the student. Similarly, a fellow may be assessed on only the most applicable CMs during any one clinical rotation. For example, some CMs will only be relevant to outpatient clinics, others to consultation or ICU rotations. Some CMs, such as professionalism or medical knowledge and care of the patient with COPD, will be taught and can be assessed in many settings during fellowship training. Others, such as knowledge and care of a patient with a rare lung disease, may have scarce opportunity for teaching or assessment. However, the goal over the course of fellowship training is for a larger picture to emerge from a series of snapshots. Fellows will learn their strengths and weaknesses, as will their program directors.

TABLE 1] Entrustable Professional Activities for Pulmonary Medicine and Critical Care Medicine

Pulmonary	Critical Care
1. Manage care of patients with acute common pulmonary diseases across multiple care settings	1. Manage patients with acute complex medical and surgical disorders in the ICU setting
2. Manage care of patients with acute complex pulmonary diseases across multiple care settings	2. Resuscitate, stabilize, and care for unstable or critically ill patients
3. Manage care of patients with chronic, advanced, or end-stage pulmonary diseases across multiple care settings	3. Provide critical care consultation to other medical and nonmedical specialties
4. Resuscitate, stabilize, and care for unstable or critically ill patients	4. Lead a multidisciplinary critical care medicine team
5. Provide perioperative pulmonary assessment and care	5. Promote optimal critical care outcomes by managing ICU triage, appropriate use of ICU resources, and transitions of care
6. Provide pulmonary medicine consultation to other medical and nonmedical specialties in both inpatient and outpatient settings	6. Advocate for individual patients
7. Lead a multidisciplinary critical care medicine team	7. Facilitate the learning of patients, families, and members of the interdisciplinary team
8. Manage transitions of care across multiple health-care settings	8. Facilitate family meetings including advanced directive and end-of-life decisions
9. Advocate for individual patients	9. Provide palliative care to patients and their families
10. Facilitate the learning of patients, families, and members of the interdisciplinary team	10. Safely and efficiently perform common critical care procedures, including bronchoscopy, thoracentesis, central venous catheter placement, and ultrasound
11. Facilitate family meetings including advanced directive and end-of-life decisions	11. Practice personal habits of lifelong learning
12. Provide palliative care to patients and their families	12. Demonstrate professional behavior
13. Safely and efficiently perform common pulmonary and critical care procedures, including bronchoscopy, thoracentesis, central venous catheter placement, and ultrasound	13. Improve the quality and safety of health care at both the individual and systems levels
14. Provide appropriate screening and preventive care	
15. Interpret pulmonary function and cardiopulmonary exercise tests	
16. Practice personal habits of lifelong learning	
17. Demonstrate professional behavior	
18. Improve the quality and safety of health care at both the individual and systems levels	

Full use of these CMs will require additional steps. First, program directors should review their current program structures to ensure that all these CMs are addressed in training. The specific formats with which they are taught will vary with local resources; common conditions or skills will be learned through didactics, study, and clinical experiences, whereas uncommon conditions may only be lectured on or discussed in the context of a differential diagnosis. Not all fellows will conduct primary investigation, although all should acquire the skills to critically appraise the medical literature and to present topics to colleagues.

Second, a subset of the CMs must be selected for the assessment of fellows' competence during training, again based on the local resources and environment. Tools for assessment can then be devised to address the selected CMs. This important process is beyond the scope of this document. Assessment may be based on tools already in use for the assessment of residents using the internal medicine reporting milestones. Assessment tools for common use will also be developed and made available by the APCCMPD.

We recognize a number of concerns about and limitations to these CM lists. The first potential objection is

TABLE 2] Entrustable Professional Activities for Combined Pulmonary and Critical Care Medicine

Combined Pulmonary and Critical Care
1. Manage care of patients with acute common pulmonary diseases across multiple care settings
2. Manage care of patients with acute complex pulmonary diseases across multiple care settings
3. Manage care of patients with chronic, advanced, or end-stage pulmonary diseases across multiple care settings
4. Manage patients with acute complex medical and surgical disorders in the ICU setting
5. Resuscitate, stabilize, and care for unstable or critically ill patients
6. Provide perioperative pulmonary assessment and care
7. Provide pulmonary medicine and critical care consultation to other medical and nonmedical specialties in both inpatient and outpatient settings
8. Lead a multidisciplinary critical care medicine team
9. Promote optimal critical care outcomes by managing ICU triage, appropriate use of ICU resources, and transitions of care
10. Manage transitions of care across multiple health-care settings
11. Advocate for individual patients
12. Facilitate the learning of patients, families, and members of the interdisciplinary team
13. Facilitate family meetings including advanced directive and end-of-life decisions
14. Provide palliative care to patients and their families
15. Safely and efficiently perform common pulmonary and critical care procedures, including bronchoscopy, thoracentesis, central venous catheter placement, and ultrasound
16. Provide appropriate screening and preventive care
17. Interpret pulmonary function and cardiopulmonary exercise tests
18. Practice personal habits of lifelong learning
19. Demonstrate professional behavior
20. Improve the quality and safety of health care at both individual and systems levels

the language we use. We have adopted the naming conventions used by the ACGME for the milestones.[6,9] However, we believe these terminologies are abstruse, with significant potential to confuse. The reporting milestones have been referred to in the literature generically just as "milestones," as "evaluation milestones," and as "subcompetencies." The term milestone has also been used to indicate the overall subcompetency (eg, "knowledge of diagnostic and testing procedures"), as well as the steps within that subcompetency that range from critical deficiency to aspirational achievement. The CMs that we present here have also been called "developmental milestones," and do not include the discrete steps that have been published with the reporting milestones. We have shared our concern regarding this lexicon with the ACGME but we use their terminology consistently to avoid creating additional confusion.

Another concern we freely acknowledge is that not everyone will agree with the consensus lists of CMs and EPAs that we provide. Many program directors, educators, and trainees may feel we have included unnecessary content, excluded important areas, lumped or split topics too much, or worded some statements incorrectly. However, this is the nature of the consensus process. In support of our conclusions, our committee included broad expertise and experience in the clinical content, prior curriculum development in the field, ACGME and ABIM milestones, and the practical details of fellowship program management. Several of the authors (H. E. F., D. A.-H., J. D. B., S. M. P., C. A. P., and A. S.) participated in the writing of the internal medicine subspecialty reporting milestones.[9] We used a formal and transparent consensus-building process. Although imperfect, the final lists of CMs and EPAs reconcile several overlapping lists, including the existing ACGME program requirements,[11-13] the competency and procedural skill measures used by the ABIM,[15] and published curricula for PCCM.[10] Our lists are similar in length and detail to those that have been developed for other subspecialties and residency programs. Program directors, however, are free to emphasize topics to a greater or lesser degree based on their preferences and local resources.

Finally, there are medical knowledge and patient care items that will diverge increasingly from evolving

TABLE 3] Curricular Milestones for Pulmonary Medicine, Critical Care Medicine, and Combined Pulmonary and Critical Care Medicine Training Programs for the Core Competencies of Systems-based Practice, Practice-based Learning and Improvement, Interpersonal and Communication Skills, and Professionalism

ACGME Core Competency	ACGME Subcompetency	Pulmonary and/or Critical Care Curricular Milestones
Systems-based practice	Works effectively within an interprofessional team (eg, peers, consultants, nursing, ancillary professionals, and other support personnel) (SBP1) Recognizes system error and advocates for system improvement (SPB2) Identifies forces that impact the cost of health care, and advocates for and practices cost-effective care (SBP3) Transitions patients effectively within and across health delivery systems (SBP4)	1. Work effectively in various health-care delivery settings and systems 2. Transition patients within and across health delivery systems 3. Incorporate considerations of cost awareness and risk-benefit analysis into patient care 4. Advocate for quality patient care and optimal patient-care systems Assist patients in dealing with system complexities 5. Work in an interprofessional team to enhance patient safety and improve patient-care quality 6. Participate in identifying system errors and in implementing potential system solutions 7. Acquire skills to organize, administer, and direct a clinical care unit such as an ICU, pulmonary function laboratory, respiratory therapy section, or outpatient practice and to work effectively as a member of a multidisciplinary team
Practice-based learning and improvement	Monitors practice with a goal of improvement (PBLI1) Learns and improves via performance audit (PBLI2) Learns and improves via feedback (PBLI3) Learns and improves at the point of care (PBLI4)	1. Identify strengths, deficiencies, and limits in one's knowledge and expertise 2. Set learning and improvement goals 3. Systematically analyze practice, using quality improvement methods, and implement changes with the goal of practice improvement 4. Incorporate formative evaluation feedback into daily practice 5. Locate, appraise, and assimilate evidence from scientific studies related to patients' health problems 6. Use information technology to optimize learning 7. Participate in the education of patients, families, students, residents, and other health professionals

(Continued)

TABLE 3] *(continued)*

ACGME Core Competency	ACGME Subcompetency	Pulmonary and/or Critical Care Curricular Milestones
Interpersonal and communication skills	Communicates effectively with patients and caregivers (ICS1) Communicates effectively in interprofessional teams (eg, peers, consultants, nursing, ancillary professionals, and other support personnel) (ICS2)	1. Communicate effectively with patients and families across a broad range of socioeconomic and cultural backgrounds 2. Communicate effectively with physicians, other health professionals, and health-related agencies 3. Work effectively as a consultant to, or member or leader of, a health-care team or other professional group 4. Maintain comprehensive, timely, and legible medical records
Professionalism	Has professional and respectful interactions with patients, caregivers, and members of the interprofessional team (eg, peers, consultants, nursing, ancillary professionals, and support personnel) (PROF1) Accepts responsibility and follows through on tasks (PROF2) Responds to each patient's unique characteristics and needs (PROF3) Exhibits integrity and ethical behavior in professional conduct (PROF4)	1. Adhere to basic ethical principles: autonomy, beneficence, nonmalfeasance, justice Demonstrate an attitude of caring derived from humanistic and professional values 2. Demonstrate compassion, integrity, and respect for others 3. Maintain accountability to patients, society, and the profession Demonstrate punctuality, reliability, and follow-through on commitments Prioritize patient needs above self-interest 4. Demonstrate sensitivity and responsiveness to a diverse patient population, including but not limited to, diversity in sex, age, culture, race, religion, disabilities, health problems, and sexual orientation 5. Recognize personal limitations and seek and accept assistance or supervision 6. Demonstrate high standards of ethical behavior Maintain appropriate boundaries and relationships with patients, other physicians, and other health-care team members

ACGME = Accreditation Council for Graduate Medical Education.

TABLE 4] Medical Knowledge and Patient Care Curricular Milestones for Pulmonary Medicine and Critical Care Medicine

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
Medical knowledge Clinical knowledge (MK1) Knowledge of diagnostic testing and procedure (MK2) Scholarship (MK3)	Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiologic, and social behavioral sciences, as well as the application of this knowledge to patient care in the following areas:	Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiologic, and social behavioral sciences, as well as the application of this knowledge to patient care in the following areas:
	1. The scientific method of problem solving	1. The scientific method of problem solving
	2. Evidence-based clinical decision-making	2. Evidence-based clinical decision-making
	3.[a] The basic sciences, with particular emphasis on Genetics and molecular biology as they relate to pulmonary diseases Developmental biology Pulmonary physiology and pathophysiology Biochemistry, cell and molecular biology, and immunology, as they relate to pulmonary disease Principles of pharmacology and therapeutics	3.[a] The basic sciences, with particular emphasis on Genetics and molecular biology as they relate to critical illness Developmental biology Physiology and pathophysiology of organ systems commonly involved in critical illness (cardiovascular, pulmonary, renal, neurologic, GI, and hepatic) Biochemistry, cell and molecular biology, and immunology, as they relate to critical illness Principles of pharmacology and therapeutics
	4. Microbiology, host defense, antimicrobial resistance	4. Microbiology, host defense, antimicrobial resistance
	5. Management of the critically ill from disasters, including those caused by chemical and biologic agents	5. Management of the critically ill from disasters, including those caused by chemical and biologic agents
	6. The psychosocial effects of acute and chronic illness on patients and their families	6. The psychosocial effects of acute and chronic illness on patients and their families
	7. The ethical, economic, and legal aspects of illness	7. The ethical, economic, and legal aspects of illness
	8. Nutrition in acute and chronic illness	8. Nutrition in acute and chronic illness
	9. Palliative care and end-of-life transitions	9. Palliative care and end-of-life transitions
	10. Disease prevention through lifestyle and environmental modifications and vaccination	[b]
	11. Principles of screening for pulmonary disease	[b]
	12.[a] Health-care policy and environmental policy relevant to lung disease	10.[a] Health-care policy relevant to critical care
	13. Study design, statistical analysis, data presentation, and interpretation in published literature	11. Study design, statistical analysis, data presentation, and interpretation in published literature
	14. Formulation of original investigative questions in medical science, patient care, medical systems performance, or education	12. Formulation of original investigative questions in medical science, patient care, medical systems performance, or education

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	15. Participation in a mentored or collaborative project in medical discovery, patient care, quality improvement, or education	13. Participation in a mentored or collaborative project in medical discovery, patient care, quality improvement, or education
	16. Dissemination of original findings or scholarly literature review in local, regional, or national forums, as oral presentations, abstracts, or publications	14. Dissemination of original findings or scholarly literature review in local, regional, or national forums, as oral presentations, abstracts, or publications
	17.[a] Effects of pregnancy, aging, obesity, and sleep on respiratory physiology	15.[a] Physiologic effects of pregnancy, sleep, aging, and obesity
Patient care Gathers and synthesizes essential and accurate information to define each patient's clinical problem(s) (PC1) Develops and achieves comprehensive management plan for each patient (PC2) Manages patients with progressive responsibility and independence (PC3) Skill in performing procedures (PC4) Requests and provides consultative care (PC5)	Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of disease and the promotion of health. They must demonstrate the application of their medical knowledge to achieve competence in the practice of health promotion, disease prevention, diagnosis, care, and treatment of patients of each sex, from adolescence to old age, during health and all stages of illness in patients with	Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of disease and the promotion of health. They must demonstrate the application of their medical knowledge to achieve competence in the practice of health promotion, disease prevention, diagnosis, care, and treatment of patients of each sex, from adolescence to old age, during all stages of critical illness in patients with
	1. Obstructive lung diseases, including Asthma Bronchitis Emphysema Cystic fibrosis Bronchiectasis	1. Obstructive lung diseases, including Asthma Bronchitis Emphysema Cystic fibrosis Bronchiectasis
	2.[a] Anatomic, developmental, and functional disorders of the airway and lung	2.[a] Anatomic, developmental, and functional disorders of the upper airway
	3.[a] Primary and metastatic malignancy of the lung and thorax	3.[a] Complications of malignancy or its treatment in the critically ill patient
	4. Benign neoplasms of the lung and airways	[b]
	5. Paraneoplastic syndromes	4. Paraneoplastic syndromes

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	6.[a] Respiratory infections of the upper and lower airway, including Community-acquired, ventilator-acquired, and heath-care-associated pneumonia Lung abscess Parapneumonic effusions and empyema Epidemic lung infections Pneumonia in immunocompromised hosts Mediastinitis	5.[a] Severe infections, including Community-acquired, ventilator-acquired, and heath-care-associated pneumonias Lung abscess Parapneumonic effusions and empyema Epidemic lung infections Opportunistic infections in the immunocompromised host Meningitis and encephalitis Endocarditis Severe infections of the kidney and collecting system, skin and soft tissue, GI, bloodstream Mediastinitis
	7. Tobacco use and smoking cessation	6. Tobacco use and smoking cessation
	8. Diffuse parenchymal lung diseases of known cause or idiopathic origin, primary to the lung or occurring in association with other systemic diseases, including Idiopathic interstitial pneumonias Eosinophilic lung disease Sarcoidosis	[b]
	9.[a] Sleep-disordered breathing and nonrespiratory sleep disorders, including Central sleep apnea and OSA Hypoventilation syndromes Insomnia Narcolepsy Restless leg syndrome	7.[a] Sleep-disordered breathing, including Central sleep apnea and OSA Hypoventilation syndromes
	10.[a] Lung transplant indications, selection, and pre-and posttransplant care	8.[a] Solid and hematopoietic transplant peritransplant care
	11.[a] Respiratory complications in recipients of nonpulmonary organ or bone marrow transplant	9.[a] Life-threatening complications in recipients of nonpulmonary organ or bone marrow transplant
	12. Acute and chronic venous thromboembolic disease	10. Acute and chronic venous thromboembolic disease
	13. Pulmonary arterial hypertension with primary and secondary causes	11. Pulmonary arterial hypertension with primary and secondary causes
	14.[a] Pulmonary manifestations of hematologic diseases	12.[a] Critical care manifestations of hematologic diseases
	15. Pulmonary hemorrhage	13. Pulmonary hemorrhage

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	16. Occupational and environmental diseases of the airways and lung parenchyma, including Occupational asthma Hypersensitivity pneumonitis Pneumoconiosis Alterations in barometric pressure (altitude and diving)	[b]
	[b]	14. Diseases due to alterations in barometric pressure, including Altitude Diving Applications of hyperbaric therapy
	17. Acute and chronic aspiration syndromes, including foreign bodies	15. Acute and chronic aspiration syndromes, including foreign bodies
	18. Pleural effusions, including Transudates Exudates Empyemas Malignancy Hemothorax Chylothorax	16. Pleural effusions, including Transudates Exudates Empyemas Malignancy Hemothorax Chylothorax
	19. Pneumothorax, including Iatrogenic Spontaneous Disease-associated	17. Pneumothorax, including Iatrogenic Spontaneous Disease-associated
	20. Diseases of the chest wall or respiratory muscles, including Neuropathies Myopathies Muscular dystrophies Phrenic nerve dysfunction Chest wall trauma or deformities	[b]
	21. Respiratory failure due to Obstructive lung disease Parenchymal lung disease Neuromuscular disorders Disorders of central drive or chest wall Benign and malignant neoplasms of the lung and airways	18. Respiratory failure due to Obstructive lung disease Parenchymal lung disease Neuromuscular disorders Disorders of central drive or chest wall Benign and malignant neoplasms of the lung and airways

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	22. Need for sedative, analgesic, and paralytic agents	19. Need for sedative, analgesic, and paralytic agents
	23. ARDS	20. ARDS
	24. Sepsis and septic shock	21. Sepsis and septic shock
	25. Shock from hypovolemic, cardiogenic, obstructive, and distributive causes	22. Shock from hypovolemic, cardiogenic, obstructive, and distributive causes
	[b]	23. Acute coronary syndromes
	[b]	24. Recognition and management of life-threatening arrhythmias
	26. Need for resuscitation from cardiac arrest and postarrest management	25. Need for resuscitation from cardiac arrest and postarrest management
	27. Right- and/or left-sided heart failure	26. Right- and/or left-sided heart failure
	[b]	27. Acute and chronic cardiac valvular disorders
	[b]	28. Hypertensive crisis
	28. Pain, delirium, or anxiety associated with critical illness	29. Pain, delirium, or anxiety associated with critical illness
	[b]	30. Neuropathies and myopathies of critical illness
	[b]	31. Coma
	[b]	32. Status epilepticus
	[b]	33. Intracranial hemorrhage and infarction
	29. Brain death and organ donation	34. Brain death and organ donation
	30. Renal disorders in the critically ill patient	35. Renal disorders in the critically ill patient
	[b]	36. Nephrotoxic drugs and drug monitoring
	31. Acid-base and electrolyte disturbances	37. Acid-base and electrolyte disturbances
	[b]	38. Acute and chronic liver failure
	[b]	39. Acute disorders of the biliary tree or biliary stasis
	[b]	40. Acute and chronic pancreatitis
	[b]	41. Acute abdominal conditions, including Abdominal compartment syndrome Bowel ischemia/infarction, obstruction, ileus, perforation Peritonitis
	[b]	42. Infectious colitis and its complications
	[b]	43. Acute upper and lower GI bleeding

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	32. Postoperative critical care monitoring and management	44. Postoperative critical care monitoring and management
	[b]	45. Critical care complications of pregnancy
	33.[a] Respiratory effects of drug abuse	46. Respiratory and critical care effects of drug abuse
	[b]	47.[a] Disorders of thrombosis and coagulation
	[b]	48. Hemolytic syndromes
	[b]	49. Transfusion indication and management of adverse reaction
	34.[a] Anaphylaxis and angioedema	50.[a] Life-threatening allergic reactions
	35.[a] Environmental injuries, including Near-drowning Carbon monoxide poisoning Radiation injury Inhalation injury	51.[a] Environmental injuries, including Hyper- and hypothermia Electrocution Near-drowning Carbon monoxide poisoning Radiation injury Inhalation injury
	36. Critical illness from disasters, including those caused by chemical and biologic agents	52. Critical illness from disasters, including those caused by chemical and biologic agents
	37.[a] Pulmonary complications of immunologic and rheumatologic illnesses	53.[a] Life-threatening complications of immunologic or rheumatologic illnesses
	[b]	54. Diagnosis and management of uni- or multisystem trauma in the ICU setting
	[b]	55. Multisystem organ failure
	38. Respiratory failure requiring long-term mechanical ventilation	56. Respiratory failure requiring long-term mechanical ventilation
	39. Sequelae of ICU care	57. Sequelae of ICU care
	40. Pulmonary rehabilitation	[b]
	[b]	58. Oncologic emergencies, including Tumor lysis syndrome Superior vena cava syndrome Hypercalcemia Intracranial mass Spinal cord compression

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	41.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, and must be able to perform them without supervision: Sedation for patients undergoing procedures Bag-and-mask airway management Endotracheal intubation Management and direction of the use of noninvasive mechanical ventilation Management and direction of the use of invasive mechanical ventilation and withdrawal of ventilatory support Thoracentesis Central venous catheterization Use of ultrasound for vascular and pleural access Chest tube placement and management Bedside pulmonary artery catheterization Arterial blood sampling Arterial catheterization Advanced Cardiac Life Support Protocol Tracheostomy tube management and decannulation Use of paralytic agents Bronchoscopy, including Airway inspection BAL Secretion clearance Needle or forceps biopsy of airway lesions Transbronchial biopsy of diffuse or localized lesions Transbronchial needle aspiration of accessible lymph nodes Management and direction of the use of respiratory therapy techniques, including Inhaled medication delivery Chest physiotherapy Manage and direct the use of oxygen delivery techniques, including Nasal cannula and mask systems Storage and delivery systems for domiciliary oxygen	59.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, and must be able to perform them without supervision: Sedation for patients undergoing procedures Bag-and-mask airway management Endotracheal intubation Management and direction of the use of non-invasive mechanical ventilation Management and direction of the use of invasive mechanical ventilation and withdrawal of ventilatory support Thoracentesis Central venous catheterization Use of ultrasound for vascular and pleural access Chest tube placement and management Bedside pulmonary artery catheterization Arterial blood sampling Arterial catheterization Advanced Cardiac Life Support Protocol Tracheostomy tube management and decannulation Use of paralytic agents Bronchoscopy, including Airway inspection BAL Secretion clearance Management and direction of the use of respiratory therapy techniques, including Inhaled medication delivery Chest physiotherapy Management and direction of the use of oxygen delivery techniques, including Nasal cannula and mask systems

(Continued)

TABLE 4] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary	Critical Care
	42.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and independent interpretation of findings from the following therapies, technologies, or diagnostic procedures: Arterial blood gases Chest radiographs Chest CT scans Bedside hemodynamic monitoring systems Brain death determination Pulmonary function testing, including bronchoprovocation Cardiopulmonary and functional exercise testing	60.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and independent interpretation of findings from the following therapies, technologies, or diagnostic procedures: Arterial blood gases Chest radiographs Chest CT scans Bedside hemodynamic monitoring systems Brain death determination
	43.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, but need not be capable of performing them or interpreting findings independently: Percutaneous needle biopsy of lung lesions Thoracoscopy Open lung biopsy Transcutaneous pacemakers Percutaneous and operative tracheostomy	61.[a] Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, but need not be capable of performing them or interpreting findings independently: Percutaneous needle biopsy of lung lesions Thorascoscopy Open lung biopsy Transcutaneous pacemakers Percutaneous and operative tracheostomy Renal replacement therapy

See Table 3 legend for expansion of abbreviation.

[a]Milestone in which the wording differs for pulmonary vs critical care.

[b]Elements for which competence is required for only one field or the other.

TABLE 5] Medical Knowledge and Patient Care Curricular Milestones for Pulmonary and Critical Care Medicine

ACGME Core Competency and Subcompetencies	Pulmonary and Critical Care
Medical knowledge Clinical knowledge (MK1) Knowledge of diagnostic testing and procedures (MK2) Scholarship (MK3)	Fellows must demonstrate knowledge of established and evolving biomedical, clinical, epidemiologic, and social behavioral sciences, as well as the application of this knowledge to patient care, in the following areas:
	1. The scientific method of problem solving
	2. Evidence-based clinical decision-making
	3. The basic sciences, with particular emphasis on Genetics and molecular biology as they relate to pulmonary diseases and critical illness Developmental biology Physiology and pathophysiology of the lungs, as well as other organ systems commonly involved in critical illness (cardiovascular, renal, neurologic, GI, and hepatic) Biochemistry, cell and molecular biology, and immunology, as they relate to pulmonary disease and critical illness Principles of pharmacology and therapeutics
	4. Microbiology, pulmonary host defense, antimicrobial resistance
	5. Management of the critically ill from disasters, including those caused by chemical and biologic agents
	6. The psychosocial effects of acute and chronic illness on patients and their families
	7. The ethical, economic, and legal aspects of illness
	8. Nutrition in acute and chronic illness
	9. Palliative care and end-of-life transitions
	10. Disease prevention through lifestyle and environmental modifications and vaccination
	11. Principles of screening for pulmonary disease
	12. Health-care policy and environmental policy relevant to lung disease or critical illness
	13. Study design, statistical analysis, data presentation, and interpretation in published literature
	14. Formulation of original investigative questions in medical science, patient care, medical systems performance, or education
	15. Participation in a mentored or collaborative project in medical discovery, patient care, quality improvement, or education
	16. Dissemination of original findings or scholarly literature review in local, regional, or national forums as oral presentations, abstracts, or publications
	17. Physiologic effects of pregnancy, sleep, aging, and obesity that relate to pulmonary disease or critical illness
Patient care Gathers and synthesizes essential and accurate information to define each patient's clinical problem(s) (PC1) Develops and achieves comprehensive management plan for each patient (PC2) Manages patients with progressive responsibility and independence (PC3) Has skill in performing procedures (PC4) Requests and provides consultative care (PC5)	Fellows must be able to provide patient care that is compassionate, appropriate, and effective for the treatment of disease and the promotion of health. They must demonstrate the application of their medical knowledge to achieve competence in the practice of health promotion, disease prevention, diagnosis, and care and treatment of patients of each sex, from adolescence to old age, during health and all stages of chronic, acute, or critical illness in patients with

(Continued)

TABLE 5] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary and Critical Care
	1. Obstructive lung diseases, including Asthma Bronchitis Emphysema Cystic fibrosis Bronchiectasis
	2. Anatomic, developmental, and functional disorders of the airway and lung
	3. Complications of malignancy or its treatment in the critically ill patient
	4. Primary and metastatic malignancy of the lung and thorax
	5. Benign neoplasms of the lung and airways
	6. Paraneoplastic syndromes
	7. Respiratory infections of the upper and lower airways, and other infections, including Community-acquired, ventilator-acquired, and heath-care-associated pneumonias Lung abscess Parapneumonic effusions and empyema Epidemic lung infections Pneumonia or severe opportunistic infections in immunocompromised hosts Mediastinitis Meningitis and encephalitis Endocarditis Severe infections of the kidney and collecting system, skin and soft tissue, GI, bloodstream
	8. Tobacco use and smoking cessation
	9. Diffuse parenchymal lung diseases of known cause or idiopathic origin, primary to the lung or occurring in association with other systemic diseases, including Idiopathic interstitial pneumonias Eosinophilic lung disease Sarcoidosis
	10. Sleep-disordered breathing and nonrespiratory sleep disorders, including Central sleep apnea and OSA Hypoventilation syndromes Insomnia Narcolepsy Restless leg syndrome
	11. Lung transplant indications, selection, pre-and posttransplant care
	12. Perioperative care of hematopoietic or solid organ transplant
	13. Lung or life-threatening nonpulmonary complications in recipients of nonpulmonary organ or bone marrow transplant
	14. Acute and chronic venous thromboembolic disease
	15. Pulmonary arterial hypertension with primary and secondary causes
	16. Pulmonary and critical care manifestations of hematologic diseases
	17. Pulmonary hemorrhage

(Continued)

TABLE 5] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary and Critical Care
	18. Occupational and environmental diseases of the airways and lung parenchyma, including Occupational asthma Hypersensitivity pneumonitis Pneumoconiosis
	19. Diseases caused by alterations in barometric pressure, including Altitude Diving Applications of hyperbaric therapy
	20. Acute and chronic aspiration syndromes, including foreign bodies
	21. Pleural effusions, including Transudates Exudates Empyemas Malignancy Hemothorax Chylothorax
	22. Pneumothorax, including Iatrogenic Spontaneous Disease-associated
	23. Diseases of the chest wall or respiratory muscles, including Neuropathies Myopathies Muscular dystrophies Phrenic nerve dysfunction
	24. Respiratory failure caused by Obstructive lung disease Parenchymal lung disease Neuromuscular disorders Disorders of central drive or chest wall Benign and malignant neoplasms of the lung and airways
	25. Need for sedative, analgesic, and paralytic agents
	26. ARDS
	27. Sepsis and septic shock
	28. Shock from hypovolemic, cardiogenic, obstructive, and distributive causes
	29. Acute coronary syndromes
	30. Recognition and management of life-threatening arrhythmias
	31. Need for resuscitation from cardiac arrest and postarrest management
	32. Right- and/or left-sided heart failure
	33. Acute and chronic cardiac valvular disorders
	34. Hypertensive crisis
	35. Pain, delirium, or anxiety associated with critical illness
	36. Neuropathies and myopathies of critical illness
	37. Coma
	38. Status epilepticus
	39. Intracranial hemorrhage and infarction
	40. Brain death and organ donation

(Continued)

TABLE 5] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary and Critical Care
	41. Renal disorders in the critically ill patient
	42. Nephrotoxic drugs and drug monitoring
	43. Acid-base and electrolyte disturbances
	44. Acute and chronic liver failure
	45. Acute disorders of the biliary tree or biliary stasis
	46. Acute and chronic pancreatitis
	47. Acute abdominal conditions, including Abdominal compartment syndrome Bowel ischemia/infarction, obstruction, ileus, perforation Peritonitis
	48. Infectious colitis and its complications
	49. Acute upper and lower GI bleeding
	50. Postoperative critical care monitoring and management
	51. Pulmonary and critical care complications of pregnancy
	52. Respiratory and critical care effects of drug abuse
	53. Disorders of thrombosis and coagulation
	54. Hemolytic syndromes
	55. Transfusion indication and management of adverse reactions
	56. Anaphylaxis, angioedema, and other life-threatening allergic reactions
	57. Environmental injuries, including Hyper- and hypothermia Electrocution Near drowning Carbon monoxide poisoning Radiation injury Inhalation injury
	58. Critical illness from disasters, including those caused by chemical and biologic agents
	59. Pulmonary or life-threatening nonpulmonary complications of immunologic or rheumatologic illnesses
	60. Diagnosis and management of uni- or multisystem trauma in the ICU setting
	61. Multisystem organ failure
	62. Respiratory failure requiring long-term mechanical ventilation
	63. Sequelae of ICU care
	64. Pulmonary rehabilitation
	65. Oncologic emergencies, including Tumor lysis syndrome Superior vena cava syndrome Hypercalcemia Intracranial mass Spinal cord compression

(Continued)

TABLE 5] *(continued)*

ACGME Core Competency and Subcompetencies	Pulmonary and Critical Care
	66. Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, and must be able to perform them without supervision: Sedation for patients undergoing procedures Bag-and-mask airway management Endotracheal intubation Management and direction of the use of noninvasive mechanical ventilation Management and direction of the use of invasive mechanical ventilation and withdrawal of ventilatory support Management and direction of the use of respiratory therapy techniques, including Inhaled medication delivery Chest physiotherapy Management and direction of the use of oxygen delivery techniques, including Nasal cannula and mask systems Storage and delivery systems for domiciliary oxygen Thoracentesis Central venous catheterization Use of ultrasound for vascular and pleural access Bronchoscopy, including Airway inspection BAL Secretion clearance Needle or forceps biopsy of airway lesions Transbronchial biopsy of diffuse or localized lesions Transbronchial needle aspiration of accessible lymph nodes Chest tube placement and management Bedside pulmonary artery catheterization Arterial blood sampling Arterial catheterization Advanced Cardiac Life Support Protocol Tracheostomy tube management and decannulation Use of paralytic agents
	67. Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, clinical use, and independent interpretation of findings from the following therapies, technologies, or diagnostic procedures: Arterial blood gases Pulmonary function testing, including bronchoprovocation Cardiopulmonary and functional exercise testing Chest radiographs Chest CT scans Bedside hemodynamic monitoring systems Brain death determination
	68. Fellows must demonstrate their understanding of the indications, contraindications, limitations, risks, diagnostic reliability, and interpretation of findings from the following procedures, but need not be capable of performing them or interpreting findings independently: Percutaneous needle biopsy of lung lesions Thoracoscopy Open lung biopsy Transcutaneous pacemakers Percutaneous and operative tracheostomy Renal replacement therapy

This table combines the curricular milestones listed separately for pulmonary medicine and critical care medicine; where the wording of similar milestones differed between the two fields, the broader version was used. See Tables 3 legend for expansion of abbreviations.

medical care. We are cognizant, however, of the requirements of the ACGME and of the ABIM, which may lag behind current practices. For example, fellows in both pulmonary training and critical care training must demonstrate competence in the insertion of pulmonary artery floatation catheters,[11,12] despite the decreasing frequency of their use.[17,18] Other procedures and technologies, such as endobronchial ultrasound, percutaneous tracheostomy, or electromagnetic navigation, may evolve toward being standards of care, whereas others, such as closed pleural biopsy, will become extinct. We are hopeful that the patient care and medical knowledge CMs will be living documents that evolve with changes in medical practice. This may be achieved through regular review and revision by the APCCMPD, a suggestion to which that organization has been receptive. Furthermore, we would greatly prefer that this list, derived with contemporary input from content experts within our subspecialty, be the driver of ACGME and ABIM regulations, rather than the converse. However, the process of revising those regulations may be lengthy, and our influence limited. In the interim, it is essential that our required curriculum as detailed here does not conflict with other published regulatory requirements.

In summary, this article proposes the curriculum milestones and EPAs that we believe define the practice of PCCM. These documents explain succinctly to the public, to legislators, to payers, and to our colleagues who we are and what we do. Together, these documents compose the destinations for fellowship training and the maps to guide us there.

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