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AI applications in pulmonary medicine

From training clinicians to transforming diagnostics and treatment

BY KRITHIKA SUBRAMANIAN, PHD

Artificial intelligence (AI) is undoubtedly dominating the contemporary cultural ethos, with pervasive, exciting, and anxiety-inducing implications for humanity. Not surprisingly, AI applications in health care are multiplying, and AI-focused research is gaining traction across specialties, including pulmonary, critical care, and sleep medicine.

"AI is being widely used across multiple domains in health care [and] across the continuum of patient care—from when the patient first presents with symptoms at the clinic all the way up to when they're undergoing a procedure or posttreatment evaluation," said William Healy, MD, FCCP, a pulmonary, critical care, and sleep medicine physician at Wellstar MCG Health Medical Center in Georgia.

AI TERMINOLOGY PRIMER

As CHEST President-Elect Neil Freedman, MD, FCCP, a pulmonary, critical care, and sleep medicine physician at Northshore University in Illinois, put it, "AI means a lot of things to a lot of people." Thus, clarity and specificity are needed regarding terminology when discussing AI applications.

AI is an umbrella term referring to the use of coded programs or algorithms for tasks requiring objective reasoning and understanding.[1] Most AI instances or programs in medicine rely on machine learning models, which identify patterns in training datasets that can then be applied to analyze new or model-naïve scenarios. Deep learning models—a subset of machine learning—involve larger training datasets, use neural networks with hidden layers, and can independently extract features from new data.[2]

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CHEST Physician, an official publication of the American College of Chest Physicians, provides cutting-edge reports on timely news, research, and clinical advances in the world of chest medicine. Regular columns feature the areas of pulmonary, critical care, and sleep medicine, as well as association news and updates from CHEST leadership.

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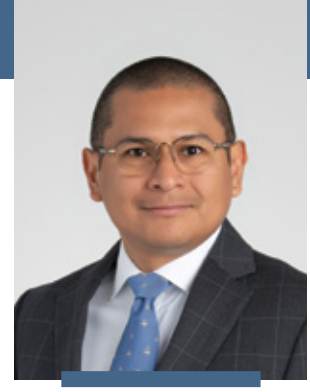
From the Editor



Colleagues,

As my four-year term as Editor in Chief of *CHEST Physician* comes to an end, I want to take a moment to reflect on what has been a truly rewarding and meaningful journey.

When I stepped into this role, my goal was simple: to make *CHEST Physician* more representative, more engaging, and more connected to the full spectrum of voices in pulmonary, critical care, and sleep medicine. While there is still work to be done, I am proud of the progress we've made. One of the areas I'm most proud of is the growth in diversity across our editorial board, giving voice to all members of the teams that care for patients every day. We brought in fresh perspectives, broadened representation, and created opportunities for dialogue that better reflect the richness of our field. I believe this has made our publication stronger and more relevant. We also added dedicated sections to spotlight the entire medical care team, including advanced practice providers. Their expertise and contributions are critical, and it was long overdue to bring their perspectives forward in a consistent and visible way.

During my tenure, we navigated a major transition in publishers, which brought changes in cadence and operations—but also opened the door for innovation. We revamped the website for a cleaner, more modern experience and introduced new features like the quarterly crossword puzzle to keep things fresh and a little more fun. A big thank you to William Kelly, MD, FCCP, for his dedication to *CHEST Physician*.

Looking ahead, I'm excited to pass the torch to the capable Diego Maselli, MD, FCCP, who will be stepping in as the next Editor in Chief. Dr. Maselli brings a thoughtful, forward-thinking approach, and I have no doubt that *CHEST Physician* will continue to grow and evolve under his leadership.

Thank you to our readers, contributors, board members, and the entire CHEST community. I also want to give a heartfelt thank you to my CHEST Editorial Team: Your talent, commitment, and collaboration have made every issue stronger. None of this progress would have been possible without your hard work behind the scenes.

It's been a privilege to serve you.

Warm regards,

Angel Coz, MD, FCCP
Editor in Chief, *CHEST Physician*

In memoriam

CHEST has been informed of the following deaths of CHEST members. We remember our colleagues and extend our sincere condolences.

Lawrence R. Dultz, MD, FCCP
Brett J. Gerstenhaber, MD, FCCP
Gary K. Iwamoto, MD, MS, FCCP
George Jablonsky, MD

All references are available in the PDF version online at **chestphysician.org/print-archive.**

Congratulations to 2025 award winners

Each year, CHEST recognizes members who are making an impact—through their dedication to the organization, their contributions to medical research and clinical practice, their commitment to educating the next generation, and so much more. Congrats to this year's well-deserving award recipients!

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Stephanie M. Levine, MD, FCCP

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MASTER CLINICIAN EDUCATOR
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Carolyn M. D'Ambrosio, MD, MS, FCCP

EARLY CAREER CLINICIAN EDUCATOR
Alice Gallo De Moraes, MD, FCCP

Network Rising Star Awards

The Network Rising Star Award, established in 2024, was created to recognize the contributions of an early career clinician practicing in their respective area under CHEST's Network structure. This award recognizes individual contributions in the areas of clinical care, education, research, and/or other scholarly activity, and someone who has shown growth and potential within the Network and CHEST. Congratulations to this year's winners!

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Richa Nahar, MD

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Inside

CHEST Puzzler Key

Scan the QR code to access the answer key to the crossword puzzle on page 15.

Column

Practice-changing updates in neurocritical care

Challenges in making correct predictions, choosing antibiotic prophylaxis, and determining transfusion thresholds in acute brain injuries

BY NEHA DANGAYACH, MD, FCCP

Acute brain injuries (ABIs) include acute ischemic stroke, subarachnoid hemorrhage (SAH), intracerebral hemorrhage (ICH), status epilepticus and hypoxic ischemic encephalopathy (HIE), meningitis, and encephalitis, among others. First, let's dive a little deeper into pneumonia and the need for mechanical ventilation in ABI before we discuss two topics: the use of prophylactic antibiotics in ABI to prevent pneumonia and how to extubate patients with ABI successfully.

PNEUMONIA AND MECHANICAL VENTILATION

Pneumonia in ABI can be characterized based on the timing from the primary neurological injury—early (within 72 hours) vs late (beyond 72 hours) pneumonia. This has implications for the potential organisms and etiologies and guides selection of empiric antibiotics. Patients who are critically ill with ABI may need to be intubated for airway protection given a high risk of aspiration; may have diminished cough and gag reflexes due to their underlying brain injuries; or may develop acute hypoxic and/or hypercarbic respiratory failure, neurogenic pulmonary edema, or ARDS as a complication of their underlying brain injury or due to the expected trajectory of their underlying neurological injury.

Patients with ABI are at a higher risk of developing pneumonia due to mechanical reasons, systemic immunological effects of the underlying brain injury, and need for prolonged mechanical ventilation—for example, due to secondary neurological injuries such as cerebral edema, raised intracranial pressure, or seizures.[1] Respiratory failure and pneumonia remain among the highest causes of morbidity and mortality in this patient population. Hence, studies that have investigated the role of prophylactic antibiotics in this patient population could potentially change our management.

THE USE OF PROPHYLACTIC ANTIBIOTICS

A recent systematic review published in the journal *CHEST*® that included seven randomized controlled trials (RCTs) recruiting N = 27,319 patients attempts to provide us with relevant clinical guidance regarding the use of prophylactic antibiotics before or after 48 hours from the primary neurological injury for a short course (24 to 72 hours).[2] Only two of the seven trials included in this review were multicenter French trials. While the organisms that cause early vs late pneumonia in patients with ABI may vary depending on the time of onset and guide empiric antibiotic coverage, most of the studies that were included in this review included antibiotics such as cefuroxime, ampicillin-sulbactam, piperacillin-tazobactam, or ceftriaxone. The authors had three a priori subgroup analyses: 1) patients with HIE would benefit less than patients with other brain injuries; 2) patients who received prophylactic antibiotics for more than 48 hours would benefit more than those who received antibiotics for less than 48 hours; and 3) patients who had antibiotics within 12 hours of being on mechanical ventilation would benefit the most. The pooled analysis showed that prophylactic antibiotics could potentially reduce ventilator-associated pneumonia (VAP) (ARR, 380 cases/1,000 vs 211 cases/1,000; RR, 0.56 [0.35-0.91]) but may not affect mortality, duration of mechanical ventilation, ICU length of stay, or functional outcomes.

Neha Dangayach, MD, FCCP

It is important to acknowledge the heterogeneity in the definitions of VAP used in these trials. It is difficult to diagnose VAP in ABI as patients can have fevers due to other causes such as central fevers or thromboembolism; they could also have chest infiltrates due to aspiration pneumonitis, pulmonary edema, atelectasis, pneumonia, or a combination of these factors. They may end up receiving antibiotics for other reasons such as perioperative antibiotic prophylaxis. Hence, these trials may end up underestimating the incidence of VAP.

Given the risk of high-resistance organisms by increasing exposure to antibiotics or the risk of *Clostridium difficile* (C. diff) colitis, the decision to administer antibiotic prophylaxis needs to be weighed against the risks. In my practice, I am planning to weigh the risk-benefit ratio of administering prophylactic antibiotics to patients with ABI. I'll assess the risk of C. diff colitis, history of prior colonization or infections with multidrug resistant organisms, and exposure to any perioperative antibiotics before administering prophylactic antibiotics to these patients. Given that the largest trial, the PROPHY-VAP: Prevention of Early Ventilation Acquired Pneumonia (VAP) in Brain Injured Patients by a Single Dose of Ceftriaxone (PROPHY-VAP) study, had 319 patients with ABI and their protocol was a single dose of ceftriaxone within 12 hours of endotracheal intubation, I think that might be the best evidence-based protocol we have.[3] In my neurosciences ICU, we are currently in the process of launching a quality improvement project to improve our documentation of VAP and implement a new protocol for VAP prevention, including our current VAP bundle (with chlorhexidine mouthwash and frequent chest physiotherapy) and a single dose of ceftriaxone.

HOW TO EXTUBATE PATIENTS WITH ABI

The European Society of Intensive Care Medicine recommendations for mechanical ventilation in patients with ABI provide some guidance on the decision to extubate patients with ABI while highlighting the paucity of literature.[4] The decision to extubate patients with ABI depends on the anticipated trajectory of the underlying primary and secondary neurological injuries, level of consciousness, and airway protective reflexes. Strategies for successful extubation in ABI have not been well studied, which prompted the international ENIO (Extubation strategies in Neuro-Intensive care unit patients and associations with Outcomes) collaboration.[5] This observational study included N = 1,512 patients from 73 ICUs in 18 countries—50% were patients with traumatic brain injuries (TBIs), and a third were patients with ICH. Extubation failure within five days of extubation occurred in 20% of patients, and 20% of patients underwent tracheostomy at day 9 (IQR, 5-15 days). The ENIO study included patients with ABI but excluded patients with postcardiac arrest HIE, patients intubated for acute neuromuscular respiratory failure, or patients who underwent withdrawal of life-sustaining therapies within 24 hours, among others.

The primary objective was to develop a validated extubation score in ABI. Extubation failure was defined as the need for reintubation by day 5. The authors split the data to create a training set (2/3) and a validation set (1/3). The ideal score had 20 variables but could not realistically be used clinically, so a simplified model with seven predictors was created; these included TBI, vigorous cough, gag reflex, swallowing attempts, endotracheal suctioning ≤ 2 times per hour, a Glasgow Coma Scale motor score of 6, and body temperature the day of extubation. However, the AUC of the score was 0.79 CI95 (0.71-0.86) in the training cohort and 0.65 CI95 (0.53-0.76) in the validation cohort. The most common causes of extubation failure included respiratory failure in more than half the patients, neurological cause in 40% of patients, and airway failure in about 40% of patients. Interestingly, the incidence of pneumonia, ICU length of stay, prolonged duration of mechanical ventilation, and mortality were similar in patients with direct tracheostomy and those who suffered from extubation failure.

The Early Tracheostomy in Ventilated Stroke Patients 2 (SETPOINT-2) study, an RCT comparing early vs delayed tracheostomy in ABI, showed that patients in the delayed tracheostomy group needed fewer tracheostomies.[6] Our ability to predict extubation success and the need for tracheostomy is limited in patients with ABI.

The NEUROlogically-impaired Extubation Timing Trial could not be completed due to the outbreak of the COVID-19 pandemic, but the authors performed an emulation by creating a pseudopopulation weighted from a retrospective cohort to understand extubation success after prompt extubation following a spontaneous breathing trial (SBT).[7] It was an interesting approach, but the only thing I learned from this study was that younger patients with seizures or TBI and less severe neurological injuries could benefit from an earlier trial of extubation. This study, however, had several limitations and lacked many variables that the ENIO study deemed to be helpful.

Hence, in my practice, I combine objective and subjective data to determine which patients with ABI will benefit from a trial of extubation and how to optimize their clinical status similar to patients without brain injuries, including volume status, quality and frequency of secretions, ability to tolerate SBT with a positive end-expiratory pressure of ≤ 7 cm of H_2O, anticipated trajectory of the underlying neurological and systemic illnesses, and airway protective reflexes—essentially, some of the variables included in the simplified ENIO score. My default approach also includes extubating these patients to high-flow nasal cannula despite lack of data to support clear benefit in this patient population, and I have found it helpful to extrapolate data to support this practice from studies in patients without brain injuries. It is important to note that uncertainty in predicting extubation success has led to widespread practice variation, and more studies are needed for us to understand the correct strategies to maximize extubation success in ABI.

TRANSFUSION THRESHOLDS

In patients who are critically ill, anemia could be seen due to a variety of reasons, including inflammation-associated bone marrow suppression, phlebotomies, acute blood loss, hemodilution due to IV fluids, reduced lifespan of RBCs, etc. Anemia has been associated with worsened outcomes in patients with ABI.[8] The TRansfusion strategies in Acute brain INjured patients (TRAIN) trial was a pragmatic RCT conducted in 72 ICUs from 22 countries evaluating two transfusion thresholds: hemoglobin (Hb) ≥ 9 g/dL vs Hb ≥ 7 g/dL in ABI.[9] The study included patients with ICH, SAH, and TBI randomized to receive a transfusion triggered by Hb < 9 g/dL (N = 408) or a restrictive transfusion triggered by Hb < 7 g/dL (N = 442) over a 28-day period. The primary outcome was unfavorable neurological outcome as measure by the Glasgow Outcome Scale-Extended-E. At six months, 246 patients (62.6%) in the liberal strategy group had an unfavorable neurological outcome compared with 300 patients (72.6%) in the restrictive strategy group (absolute difference, -10.0% [95% CI, -16.5% to -3.6%]; adjusted RR, 0.86 [95% CI, 0.79-0.94]; *P* = .002).

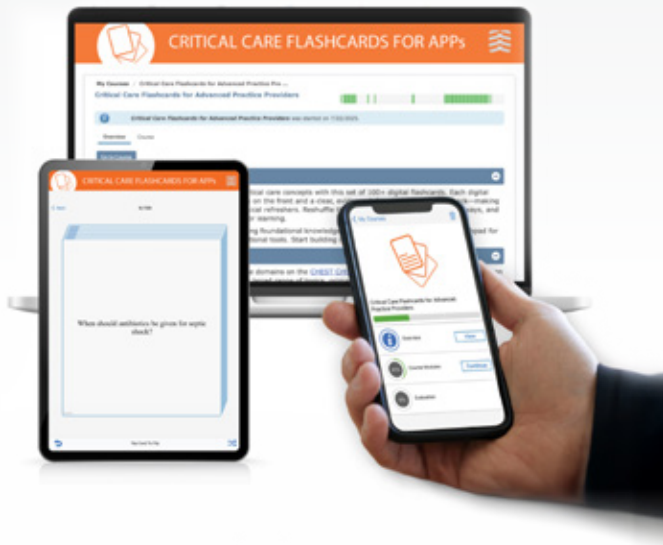
Of note, in the recently published HEMOglobin Transfusion Threshold in Traumatic Brain Injury OptimizatioN: The HEMOTION Trial (HEMOTION), a liberal transfusion strategy (Hb ≥ 10 g/dL) was associated with a nonsignificant 5.4% absolute reduction (95% CI, -2.9% to 13.7%) in the risk of unfavorable neurological outcomes at six months in patients with TBI compared with a restrictive strategy.[10] The improvement in neurological outcomes could be due to better cerebral tissue oxygenation or lesser ischemic events. However, this would need to be counterbalanced against the risk of volume overload, increasing duration of mechanical ventilation, transfusion-related acute lung injury, transfusion-associated circulatory overload, etc.

In my clinical practice, if there are no contraindications such as underlying heart failure (heart failure with reduced ejection fraction or heart failure with preserved ejection fraction), end-stage renal disease, volume overload, etc, then I might aim for a higher Hb goal in the acute phase—for example, the first week or two—to potentially improve neurological outcomes. •

Riding the Momentum of the CHEST Critical Care APP Certification Exam Launch

Thanks to the successful launch of the CHEST Critical Care APP Certification Exam, 171 advanced practice providers (APPs) completed the test to earn their CCAPP credential in 2025. But if you missed the inaugural round of applications to qualify for the exam, don't worry. CHEST plans to administer the exam again twice in 2026—in the spring from April 21 to May 8 and in the fall from October 27 to November 13.

In the meantime, CHEST has created core education modules, with foundational lectures and test review questions, to support APPs as they drill into the various topics covered on the exam.



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Column

Progress and priorities in lung transplantation

Focusing on improved donor organ utilization, equitable access, and reduced impact of CLAD

BY STEPHANIE CHANG, MD; ERIN LOWERY, MD, MS; HOLLY L. KEYT, MD, MBA, FCCP

Over the past several decades, improvements in donor selection, organ preservation, and operative strategies have expanded the pool of candidates with advanced lung disease who are able to access lung transplantation. However, access to this life-saving therapy remains limited by geographic, socioeconomic, and systemic inequalities, while long-term survival is constrained by chronic lung allograft dysfunction (CLAD), despite improvements in immunosuppression and supportive care. This perspective will address the future of lung transplantation through the intersecting challenges of improving organ utilization, equity, and CLAD, as the success of the field depends on progress in all three areas.

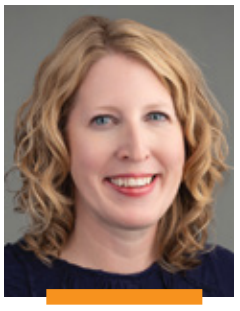
IMPROVED ORGAN UTILIZATION

One important factor in expanding access to care is to improve the utilization of lung allografts from the existing donor pool. Lungs remain one of the lowest recovered organs.[1] Despite the challenges in optimizing and sustaining donor lungs for recovery and transplant suitability, lung utilization has increased, as evidenced by a continued annual rise in the rate of lung transplantation. While increased utilization is in part due to increased access to and use of organ reperfusion and recovery technology—such as ex vivo lung perfusion (EVLP) to evaluate marginal organs, expansion of the donor pool through use of hepatitis C virus (HCV) positive donors into HCV-negative recipients (given the ability to treat and clear HCV), and increased utilization of extended criteria donors—more recent improvements in utilization can be attributed to specialized donor recovery centers and donation after circulatory death (DCD).[2-6]

ORGAN RECOVERY CENTERS

Traditional donor management and organ procurement occurs with donors remaining at the hospital where brain death is determined. This places the burden of donor management on small hospitals that do not have extensive experience or investment in donor optimization. That's why a model called an organ recovery center (ORC) was created in 2001 by the organ procurement organization (OPO) Mid-America Transplant.[7] Multiple studies have shown donor management at an ORC is associated with improved abdominal organ utilization, decreased cost, and increased efficiency compared with the traditional donor model.[8-9] With respect to lung utilization, a lung-focused resuscitation protocol at an ORC led to improved utilization from 19.8% to 33.9%.[10] Due to this success, 24 of 57 OPOs have now established some form of an ORC, with 11 OPOs having freestanding facilities, while the others use transplant centers or hospitals to utilize their intensive care beds, operating rooms, and diagnostic services for donor management.[7]

Stephanie Chang, MD



Erin Lowery, MD, MS

Holly L. Keyt, MD, MBA, FCCP

DONOR AFTER CIRCULATORY DEATH

Historically, donor lungs were procured from donations after brain death (DBD), with minimal use of lung allografts from DCD due to difficulty with evaluation of lung allografts. The rate of DCD lung allograft use in the US rose from 0.1% (N = 1) in 2001 to 5.7% (N = 197) in 2019, in part due to registry studies demonstrating equivalent outcomes between allografts from DBD and DCD and in part due to the use of EVLP to assess marginal donors after organ recovery.[11-13]

In 2020, a technique known as thoracoabdominal normothermic regional perfusion (TA-NRP) was introduced in the US as a means to assess cardiac allografts in DCD donors.[14] Early institutional experience of lung allograft utilization from TA-NRP DCD donors showed no difference in perioperative complications or short-term and long-term survival.[15] However, due to the need for standardization to optimize lung allograft quality, a consensus document was created to highlight the need for pre-donation diuresis, drainage of donor blood after the right atrial drain is placed, a vent to reduce hydrostatic pressure on the lung, early reintubation and ventilation, as well as minimizing TA-NRP time to less than 60 minutes.[16] The increase of DCD donors for all thoracic organ transplantation has led to continued significant growth in DCD lung transplant. As of September 2025, 18.5% (N = 431) of the 2,330 lung transplants performed this year have been recovered from DCD donors.[11]

EQUITY AND ACCESS TO LUNG TRANSPLANTATION

Recent studies demonstrate that inequities in access to lung transplantation in the US are both persistent and multifactorial. Despite major policy shifts, disparities remain across race, ethnicity, gender, geographic location, and socioeconomic status. For example, Black and Hispanic candidates remain less likely than White candidates to undergo transplantation, with the gaps particularly pronounced among older patients and those from higher-poverty communities.[17-20]

Measures of socioeconomic disadvantage, including the Area Deprivation Index and the Distressed Communities Index, are consistently associated with worse outcomes across the transplant continuum, from referral and evaluation through waitlist placement and posttransplant survival.[21-22] Upstream barriers, such as lower referral rates to general pulmonologists or lung transplant centers, make it less likely that patients from the most disadvantaged neighborhoods ever reach the waiting list. Even after successful transplantation, these patients face higher five-year mortality, independent of baseline clinical risk.[21-22]

These disparities reflect broader social determinants of health and systemic barriers at every stage of care.[23] Geographic barriers,

including limited proximity to a lung transplant center combined with relocation polices, can amplify socioeconomic barriers. Transplant hospitals must maintain acceptable publicly reported outcomes. Patients who have modifiable and nonmodifiable identified risks for poorer posttransplant outcomes—whether those are socioeconomic, psychosocial, or inherent in their identified comorbidities such as degree of frailty, history of cancer, or history of nonrevascularized coronary disease—the transplant team determines their own criteria for individual cases they are capable of accepting based on risk tolerance, the team's level of expertise, and resourcing.

Team resourcing in the current health care climate can factor into the number of higher-risk, high-resource cases a transplant team may accept whereas geographic proximity may limit the patient from seeking additional opinions regarding transplant candidacy following a denial by the local center. While recent policy changes seek to improve equity, the literature underscores that meaningful progress will require targeted interventions, better data collection, and intentional resource allocation to ensure equitable access and outcomes in lung transplantation.[20,24]

CHRONIC LUNG ALLOGRAFT DYSFUNCTION

Up to 50% of lung transplant recipients experience CLAD (a persistent ≥20% decline in FEV_1 from posttransplant baseline) within five years of transplant. CLAD remains the primary cause of late morbidity and mortality in lung transplant recipients and is therefore a significant focus of research efforts within the lung transplant community. Recent studies have furthered the understanding of the mechanisms, diagnosis, prognosis, and potential treatment strategies of CLAD.

The pathogenesis of CLAD reflects complex interactions between immune injury; nonimmune insults such as infection, aspiration, and ischemia/reperfusion; and repair. A recent review by Bery and colleagues emphasized that immune-mediated injury drives pathogenesis and suggests a framework that supports precision approaches to the individual processes, including cellular and humoral immune responses; autoimmunity; innate immune activation; and environmental insults such as infection, gastrointestinal reflux, and air pollution. Independent risk factors associated with probable CLAD were identified by Todd and colleagues this year and include cytomegalovirus infection, the presence of donor-specific antibodies >90 days following lung transplant, acute rejection, acute lung injury, and organizing pneumonia.[25] This study represents an important addition to the understanding of CLAD, as patients with probable CLAD have a significantly increased risk of graft loss and earlier identification of CLAD is crucial for effective intervention. Predicting CLAD before spirometric decline is potentially on the horizon through work on molecular signatures (eg, donor-derived cell-free DNA, microRNAs), immune cell subsets, and imaging modalities, which will guide preemptive therapies.

Tailored immunosuppression management is important for prevention of CLAD. The investigators of the Clinical Study Evaluating Two Treatment Protocols for Immunosuppressive Drugs: Looking at 3-year Incidence of CLAD (ScanCLAD) trial compared once-daily tacrolimus to twice-daily cyclosporin in a Scandinavian cohort and identified a significantly reduced incidence of CLAD in the tacrolimus-treated group at three years, confirming the superiority of tacrolimus for maintenance immunosuppression.[26] While Benazzo and colleagues evaluated the efficacy of extracorporeal photopheresis (ECP) for prevention of CLAD and demonstrated that patients who received ECP immediately following lung transplant had more freedom from acute cellular rejection, fewer infections, and significantly higher freedom from CLAD at three years.

Across these studies, three themes emerge: 1) early recognition of probable CLAD and immune injury predicts outcomes and creates therapeutic windows; 2) precision strategies, including biomarkers and immunomodulation, are essential for tailoring care; and 3) preventive approaches through effective immunosuppression management hold promise for delaying CLAD onset. Collectively, these findings chart a path toward improved long-term survival and quality of life for lung transplant recipients.

In summary, the future of lung transplantation depends on advancing three interconnected priorities: improving donor organ utilization, ensuring equitable access, and reducing the impact of CLAD. Progress in each area is essential in order to expand the reach of transplantation and make its benefits more durable and more just. ●

Scenes from CHEST 2025

Relive some of the best moments from Chicago by visiting the online photo gallery from the annual meeting. Find even more snapshots on social media under #CHEST2025.

AI applications

// continued from cover

The increasing significance of AI technology is exemplified by the AI Glossary, an educational resource from the US Food and Drug Administration (FDA). Additionally, medical professional societies and public health organizations, including the American Medical Association and the World Health Organization, are increasingly issuing recommendations or standards regarding AI in health care.[3-4]

Here, we will examine a sampling of AI use cases across the continuum of pulmonary medicine—from education and evaluation of trainees and fellows to the first encounter of a patient with their health care provider and further along the care pipeline in sleep medicine and lung cancer care. More in-depth looks at various AI innovations in pulmonary, critical care, and sleep medicine will be explored in future *CHEST Physician* issues.

TOOLS FOR EDUCATORS, FELLOWSHIP DIRECTORS

Alison Whelan, MD, Chief Academic Officer of the Association of American Medical Colleges (AAMC), recently noted that the era of AI-enabled transformations in education and training for US clinicians is just beginning.[5]

Bhavinkumar Dalal, MD, MBBS, FCCP, Professor of Pulmonary, Critical Care, and Sleep Medicine at Corewell Health in Michigan, agreed. "Broadly, AI applications are now being used by clinician educators for curriculum development, in learner assessments, and even for feedback and evaluation," he said.

Dr. Dalal illustrated how AI applications are being integrated into the fellow recruitment cycle at his institution. AI tools can be used to calculate *z* scores for the typical 500-strong applicant pool for the six fellowship positions per cycle. They can also summarize applications and interview feedback for short-listed applicants before interviews with faculty members.

The algorithm can then apply predefined rubrics to the qualitative summaries, folding this rubric into the *z* score calculations.

While several general AI tools, such as Copilot and ChatGPT, have been used in this context, Dr. Dalal said that his group is planning a formal study to standardize the use of AI aids and assess their impact on recruitment-related parameters.

Dr. Dalal has also used AI for developing a situational clinical judgement assessment focused on real-world issues in experienced by fellows. He said that the AI-generated test, composed of 20 questions, was a reasonable starting point. He subsequently prompted and refined the test through iterations to generate the final version. A previous study showed that AI-generated assessments for mechanical ventilator competency were comparable with human expert-created tests.[6]

Dr. Dalal and colleagues are also studying the correlation between candidate ranking based on an AI-facilitated assessment and faculty-generated ranking. Another AI-enabled curriculum for interstitial lung disease, based on Kern's six-step model, is in development.

"The AI-aided approach provided rubrics and frameworks for all six steps, which I then had to fine-tune and modify," Dr. Dalal said.

Many medical schools are in the process of implementing AI curriculums for trainee clinicians. The AAMC, for instance, has an educational series on AI that provides guidance on critical concepts and practical strategies. Likewise, the Association of Pulmonary and Critical Care Medicine Program Directors offers hands-on AI workshops for clinician educators.

AI AND THE PATIENT-PROVIDER INTERFACE

Across the spectrum of pulmonary specialists, there is consensus

PICTURED, FROM TOP:
Ritwick Agrawal, MD, MS, FCCP;
Bhavinkumar Dalal, MD, MBBS, FCCP;
Neil Freedman, MD, FCCP;
William Healy, MD, FCCP; and
William Mayfield, MD

that the most prevalent use of AI in contemporary real-world practice centers around reducing administrative workload for providers, a critical and welcome change with the potential to reduce clinician burnout.

"In general practice, for instance, Ambient AI can be used to help physicians with coding and documentation, freeing up more time to spend with patients," Dr. Freedman said. "Other AI-enabled tools [such as DAX Copilot in Epic and AI scribes] are already in use for a range of administrative tasks and to improve the patient's care experience, such as for answering patient calls, fulfilling medication refill requests, and handling insurance precertification and reimbursements."

MOVING FORWARD IN SLEEP MEDICINE

As noted by Ritwick Agrawal, MD, MS, FCCP, Director of Sleep Medicine at Northwell Health in New York, sleep medicine has traditionally been a data-rich field, typified by the seven to eight hours of data from an individual multichannel sleep study. Even before the advent of AI tools, sleep medicine specialists were pioneers in technology and digital tools, he said.

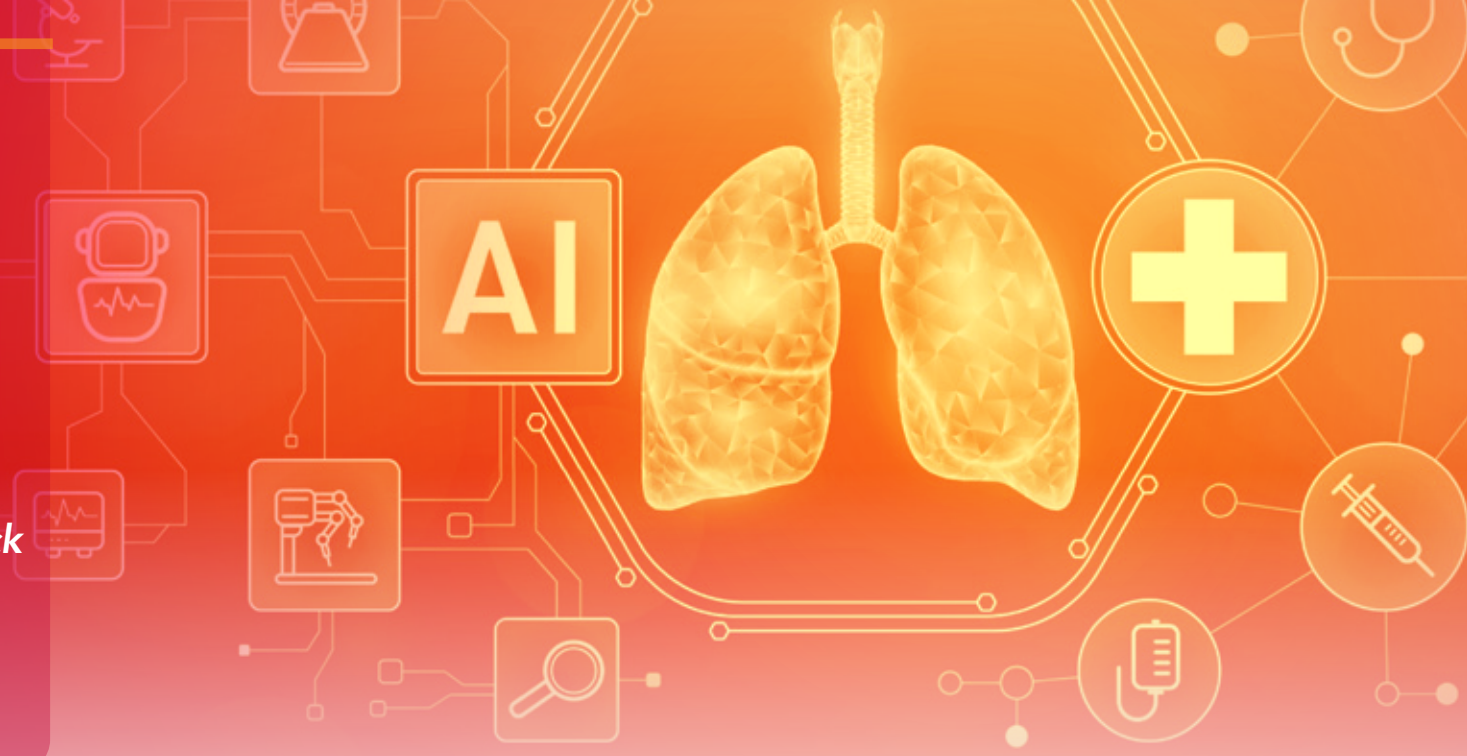
"AI tools are now being deployed to analyze multichannel sleep study results, along with the electronic medical record, to identify patients who may be at a high risk for sleep disorders and provide screening recommendations. Some of these AI tools are replacing or supplementing manual sleep study scoring," Dr. Agrawal said. "Neural network models for extracting sleep parameters from polysomnography data collected with in-home sleep diagnostic devices are being developed."

However, most AI applications in sleep medicine are still investigational or in the research setting. For example, Dr. Agrawal and colleagues are developing an AI model for assessing the STOP-Bang score, a patient-driven screening tool for OSA.

Such a tool would help address a significant unmet need, particularly in primary care: identifying patients who may be at risk of sleep disorders and guiding referrals for follow-up or testing.

Drs. Freedman and Agrawal said AI tools may also help address other challenges in sleep medicine, such

> *Broadly, AI applications are now being used by clinician educators for curriculum development, in learner assessments, and even for feedback and evaluation.*
>
> — BHAVINKUMAR DALAL, MD, MBBS, FCCP



as predicting patient tolerability and adherence to CPAP therapy or patient suitability for different treatments (eg, hypoglossal nerve stimulation or surgical approaches). The availability of validated AI tools tailored for these needs not only may improve personalized patient care and outcomes but also may help to reduce health care costs.

UNMET NEEDS IN LUNG CANCER

William Mayfield, MD, Medical Director of Lung Cancer Screening and Incidental Nodule Programs at Wellstar Health System in Georgia, is a principal investigator in the Sybil Implementation Consortium, an alliance focused on developing and implementing the Sybil AI model for predicting risk of lung cancer.[7]

Dr. Mayfield said AI has several applications in the general pathways of lung cancer, such as suspicious nodule detection, nodule characterization, and—with the development of Sybil—the potential for predicting future lung cancer risk.

Several commercially available AI tools, such as Riverain Technologies and QureE AI, can independently review CT scans, detect lung nodules, and then flag them for the radiologist. These tools may be particularly useful in settings where imaging data are reviewed by radiologists with limited experience in thoracic imaging, at high-volume centers, or in other resource-limited settings.

Other AI tools can parse radiology reports, highlight the term "nodule," and then route that report to reviewers or nurse navigators for follow-up.

"These AI tools can level the playing field for everyone," Dr. Mayfield said. "With AI-assisted identification of suspicious nodules warranting further evaluation, the radiologist's attention is focused, and they can refer patients and tailor next steps."

Another AI-enabled lung cancer prediction tool, Optellum's Lung Cancer Prediction score, is the world's first FDA-approved imaging AI/radiomics-based digital biomarker. This tool ascribes a lung cancer risk score to nodules specifically delineated by a clinician in a CT scan and designated for assessment.

The Sybil risk prediction tool was developed by researchers at the Jameel Clinic at the Massachusetts Institute of Technology. Led by Regina Barzilay, School of Engineering Distinguished Professor of AI and Health—who also spearheaded Mirai, a mammography-based risk prediction model for breast cancer—Sybil was validated in diverse cohorts, demonstrating robust and consistent performance in individualized risk prediction for lung cancer development within six years from an index CT scan image, independent of clinical or medical historical information.[8-10] Additional validation and prospective studies incorporating Sybil are planned.

"Currently, Sybil is an investigational/research tool, and many aspects must be addressed before it can be truly ready for routine clinical application and inform patient care decisions," Dr. Mayfield said.

EVOLVING USES, UNRESOLVED ISSUES, AND CHALLENGES

AI evolution in medical practice is happening rapidly, Dr. Mayfield said, "and accelerating exponentially at a rate faster than any other technology in the history of mankind."

Given this rapid expansion, growing pains are to be expected.

During this evolution, clinicians will need to understand how to work with—not be replaced by—AI tools, Dr. Freedman said.

"We need to understand the key shortcomings of these emerging tools and the governance and regulatory structures in our practices and institutions that need to be in place to optimize their use appropriately and in compliance with exiting health care regulations and privacy laws," he said.

Dr. Healy added, "Many current AI tools have narrow applications or can only be deployed in well-funded, adequately resourced care centers. Broadly applicable AI tools—prospectively validated in large datasets representing diverse populations and accessible across practice settings, including rural or resource-limited care settings—are needed."

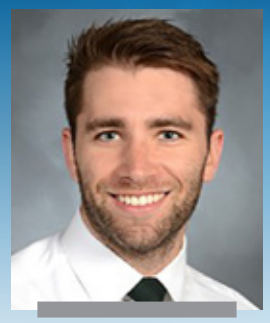
Professional medical organizations or research consortia can help assemble large datasets and provide guidance and recommendations for systematic development of AI tools, both to address research priorities and for use in clinical practice, he said.

"AI tools are certainly here to stay," Dr. Healy said, echoing the perspectives of his peers. ●

Column

CMS releases updated guidance for NIPPV in patients with COPD

Understand how it will affect patient care



BY ALEXANDER BAIN, MD; PHILIP CHOI, MD

Any pulmonologist or sleep medicine clinician who has cared for a patient with COPD in need of BPAP knows the ordeal of securing appropriate therapy. For decades, clinicians have had to navigate algorithms that often felt like unsolvable puzzles—with patients' lives at stake. In June 2025, the US Centers for Medicare & Medicaid Services (CMS) released long-awaited updates to its national coverage determination (NCD) for noninvasive positive pressure ventilation (NIPPV) in cases of chronic respiratory failure due to COPD.[1] These revisions reflect years of sustained advocacy by pulmonary and sleep clinicians, alongside patient advocates, and professional associations such as CHEST.

While the policy shift is welcome, it is important to acknowledge that it is grounded in a strong physiologic and clinical rationale. In COPD, chronic hypercapnia develops primarily from alveolar hypoventilation driven by increased dead space ventilation, ventilation-perfusion (V/Q) mismatch, elevated airway resistance, increased work of breathing, and dynamic hyperinflation. The physiologic rationale for NIPPV in this setting centers on reducing persistently elevated carbon dioxide levels, which are linked to increased susceptibility to infection, immune dysregulation, and airway dysfunction. Additional benefits include unloading of the respiratory muscles, improved sleep quality, and reduced cardiovascular strain.

Evidence supporting the use of NIPPV in COPD comes from two landmark randomized clinical trials. In 2014, Köhnlein and colleagues showed that NIPPV reduced one-year mortality among patients with clinically stable COPD when a reduction in $PaCO_2$ was targeted.[2] Three years later, Murphy and colleagues demonstrated that, in patients with persistent hypercapnia following an acute exacerbation, home NIPPV significantly prolonged the time to hospital readmission or death at 12 months.[3] In both trials, patients received "high-intensity ventilation," with driving pressures typically between 15 and 20 cm H_2O and backup respiratory rates of 14 to 16 breaths per minute. These findings directly informed subsequent European Respiratory Society and American Thoracic Society guidelines, published in 2019 and 2020, respectively.[4-5]

PRIOR CMS GUIDELINES

Despite this evidence base, implementation within the United States remained constrained by outdated CMS coverage criteria. The prior Medicare guidance for respiratory assist devices (RADs) did not align with COPD pathophysiology. Clinicians were required to demonstrate sleep oximetry with oxygen saturations ≤88% while patients were already receiving supplemental oxygen—a hurdle both irrelevant and often unattainable. Even when met, coverage permitted only BPAP without a backup rate, falling short of the high-intensity strategies validated in clinical trials. These barriers pushed many clinicians to circumvent RAD prescriptions entirely, instead turning to more costly home mechanical ventilators (HMVs) to deliver appropriate therapy. While patients often did gain access to effective treatment through the HMV pathway, this approach came at a significant financial burden to the health care system.

GUIDELINE UPDATES

The updated CMS guidance marks a significant shift in how RADs can be prescribed for patients with COPD. Most notably, the nonphysiologic requirement for sleep oximetry has been eliminated, dramatically improving access. Under the new criteria, a RAD may be prescribed for any patient with stable COPD who meets two conditions: an arterial blood gas (ABG) showing $PaCO_2 \geq 52$ mmHg while awake on prescribed oxygen, and the absence of sleep apnea as the predominant cause of hypercapnia (no formal testing required).

CMS has also introduced coverage for RAD initiation immediately following hospital discharge when clinicians judge a patient to be at risk of acute decompensation in the absence of therapy. This provision closes a dangerous care gap by allowing patients to transition directly to home therapy without delay.

Once prescribed, RAD use must be reassessed at least twice in the first year. Patients are expected to demonstrate adherence—defined as at least four hours of nightly use on 70% of days—and efficacy, either through stabilization of $PaCO_2$ levels or through relief of symptoms such as headache, fatigue, dyspnea, confusion, or poor sleep quality.

Importantly, the updated guidance still preserves access to HMVs when clinically appropriate. These devices remain an option for patients requiring higher levels of support, such as those needing ≥4 L/min of supplemental oxygen, more than eight hours of daily ventilatory assistance, additional safety features like alarms and backup batteries, or in cases where the treating clinician determines that RAD therapy alone is unlikely to achieve physiologic or symptomatic goals.

FUTURE DIRECTIONS

While the updated CMS guidelines represent an important victory for patients, clinicians, and the health care system, several caveats remain. Current coverage decisions are largely informed by randomized trials of high-intensity NIPPV in patients with advanced COPD with severe airflow limitation (mean FEV_1 <30% predicted). The ventilatory strategies applied in these studies—high inspiratory and low expiratory pressures with a set backup rate—were employed to match the physiology of individuals with high dead space ventilation and substantial ventilatory load. In real-world practice, however, patients with less severe COPD may have multiple contributors to hypercapnia, including OSA, obesity, or medication effects, which may require alternative approaches to ventilation.

Moreover, the elimination of pulmonary function test (PFT) requirements, while reducing barriers to coverage, does not obviate the role of PFTs in diagnosis and management. COPD, by definition, requires spirometric confirmation, and PFTs remain essential for understanding disease severity and tailoring therapy.

Looking ahead, gaps remain in Medicare coverage for other causes of chronic respiratory failure. Patients with nonprogressive neuromuscular disease (eg, diaphragmatic paralysis), obesity hypoventilation syndrome, and multifactorial respiratory failure (such as restrictive thoracic disease or heart failure) continue to face inadequate access under current policy. Emerging evidence suggests that patients with chronic hypercapnic respiratory failure—regardless of etiology—may derive benefit from NIPPV.[6] To fully realize this potential, future updates must move beyond disease-specific criteria and focus on the underlying pathophysiology of hypoventilation.

Achieving this will require both policy evolution and clinical innovation. Expanded training of clinicians in chronic respiratory failure management, as well as the design of pragmatic clinical trials across diverse patient populations, will be critical.[7] Ultimately, the updated CMS determination represents a model for how advocacy, physiology, and evidence can align to improve patient care. ●

Column

Establishing an outpatient pleural disease clinic

The role of the adult-gerontology acute care nurse practitioner

BY BROOKE RUANE, MSN, CRNP, AGACNP-BC, RNFA, MTTS

Consider the case of a 65-year-old patient with metastatic lung cancer who presents to the pulmonary outpatient clinic with progressive dyspnea, both with exertion and intermittently at rest. On examination, breath sounds are markedly diminished on the right side. A point-of-care ultrasound confirms a large right pleural effusion. After a multidisciplinary discussion with the patient and her oncology team, thoracentesis was recommended to guide management and provide symptom relief. The options at the time of this case were to schedule the procedure in our bronchoscopy suite with a two-day wait or present to the emergency department (ED) for immediate intervention.

Alternatively, consider a 70-year-old new patient with metastatic lung cancer and malignant pleural effusion, status post-indwelling pleural catheter (IPC) placement, who presents with dyspnea. During the history, it is learned that the IPC has not been drained in four weeks and no home health services have been arranged.

These are just two examples of the many patients who present to my outpatient clinic with acute and symptomatic pleural effusions requiring intervention and, as such, highlight deficiencies in the current care model for patients with this debilitating condition. Despite having ultrasound capability and adequate space in clinic, thoracenteses were not performed on site due to lack of supplies and infrastructure. As a result, patients are funneled into the ED or procedural suite for intervention, creating unnecessary delays, fragmented care, and a diminished patient experience. Through these and similar experiences, I recognized a gap in the management of patients presenting with acute pleural effusions in the outpatient pulmonary setting. This observation prompted me to propose the development of an outpatient pleural disease clinic designed to provide thoracentesis and IPC care safely and efficiently at the point of care.

IDENTIFYING THE GAP IN CARE

The management of pleural effusions is complex, requiring treatment of the underlying cause and interventions to remove fluid, prevent recurrence, and symptom relief. Thoracentesis, a minimally invasive procedure to drain fluid, remains a critical aspect of care, serving both diagnostic and therapeutic purposes.[1] While all new pleural effusions necessitate thoracentesis for diagnostic evaluation, malignant or recurrent effusions may require additional interventions, such as IPC placement, pleurodesis, or other therapeutic options.[2] Patient-centered care is particularly vital in managing recurrent effusions, ensuring that therapeutic decisions align with individual values, preferences, and goals. Comprehensive clinical assessment is essential to guide therapeutic decision-making, incorporating patient-specific factors to optimize outcomes and enhance quality of life (QOL).

Prior to the development of the pleural clinic at my institution, the management of pleural effusions was fragmented. Thoracentesis patients who were too unstable to wait for a bronchoscopy were advised to present to the ED, resulting in numerous patients receiving pleural effusion management and thoracentesis by ED or interventional radiology (IR) attending. This led to incomplete workups, inconsistent fluid studies, missing fluid studies, and sometimes delayed diagnoses. Additionally, opportunities for timely IPC placement were often missed, and follow-up care was poorly coordinated, with frequent referrals from outside providers and home health agencies for patients with IPCs not previously evaluated in clinic. This lack of standardized pathways contributed to repeated hospital admissions for thoracentesis and poor continuity of care. This was not only detrimental to the individual patient but also very costly to the health care institution.

ADVOCATING FOR SYSTEM-LEVEL CHANGE

In collaboration with my interventional pulmonary (IP) team, I proposed and implemented a dedicated pleural disease clinic, which I primarily staff. This model standardizes patient evaluation, provides timely access to thoracentesis and IPC placement, and ensures longitudinal follow-up through coordinated drainage schedules, home health referrals, and repeat imaging. Patients benefit from an improved experience through the continuity of care provided by a consistent clinician overseeing their management. Additionally, this model reduces the financial burden on both patients and the health care system. Referrals to our pleural clinic may be made by any specialty. Through increased access, shorter wait times, and ongoing follow-up and coordination, advanced practice providers (APPs) enhance the efficiency, quality, and continuity of care for patients with pleural disease within the IP program.[3]

A thoracentesis clinic led by nurse practitioners (NPs) offers direct, same-day outpatient care for pleural effusions, enabling NPs to perform both diagnostic and therapeutic procedures, speed up treatment, and quickly relieve patient symptoms. Literature recommends that patients with symptomatic malignant pleural effusions be referred to pleural services as early as possible to maximize QOL benefits from treatment. When an IPC is indicated, pleural services can also facilitate coordinated home drainage visits. Early intervention has been associated with a reduced risk of developing nonexpandable lung in later stages.[4] NPs broaden procedural capacity by performing procedures such as thoracentesis and managing IPCs.

PURSUING THE NECESSARY TRAINING

APPs are highly trained clinicians who play an integral part of the health care team. Current literature supports that appropriately trained APPs can safely perform minimally invasive procedures, such as ultrasound-guided thoracentesis, with complication rates comparable to those of physicians.[1] APPs have the capacity to bill independently for outpatient procedures and offer a more efficient and cost-effective route for patients as opposed to using IR.[6] Several single-center studies and reviews show that real-time ultrasound-guided thoracentesis performed by trained nonradiology providers, such as APPs under supervision, results in low complication rates and favorable outcomes. APP-performed procedures may also decrease costs and increase revenue for health care systems by freeing up interventional radiologists and pulmonologists to perform a greater volume of image interpretation or more complex procedures.[1] This evidence supports the development of APP-led outpatient thoracentesis

// continued on page 13

2025 year in review: CHEST guidelines

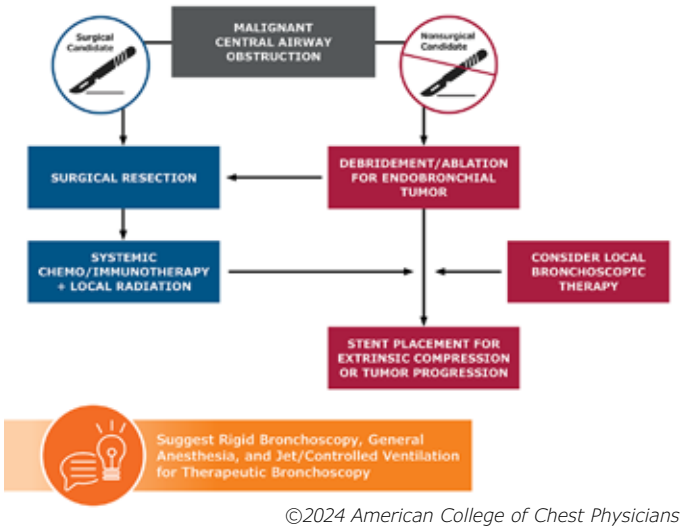
The past year brought about significant advancements in chest medicine, marked by the release of several influential guidelines that are reshaping practices across thoracic oncology, critical care, and interventional pulmonary. In this year-in-review, we summarize those key publications that highlighted major shifts in care delivery for clinicians in 2025. Each guideline integrates the latest evidence to refine diagnostic strategies, optimize therapeutic interventions, and improve patient outcomes. For each topic, you'll find a concise summary of key recommendations and an accompanying infographic (if available) to support clinical application and education. Scan the accompanying QR codes to be directed to all related educational assets and the full article from the journal *CHEST*®.

Management of Central Airway Obstruction

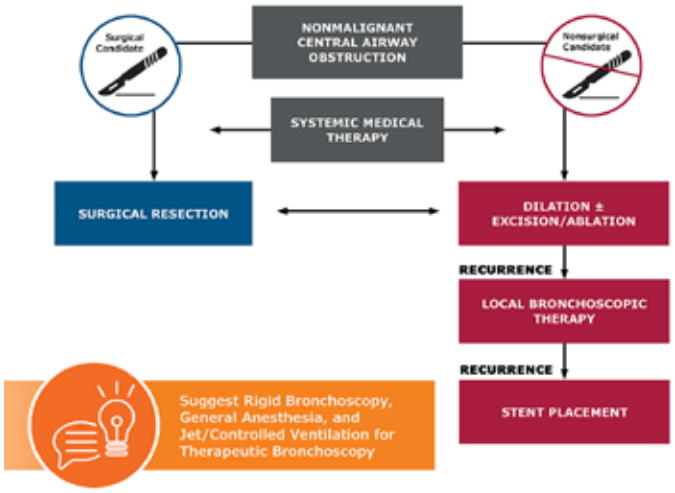
- For patients with symptomatic malignant or nonmalignant CAO, we suggest therapeutic bronchoscopy as an adjunct to systemic medical therapy and/or local radiation.
- For patients with symptomatic malignant or nonmalignant CAO, we suggest the use of rigid bronchoscopy over flexible bronchoscopy for therapeutic interventions.
- For patients with symptomatic malignant or nonmalignant CAO, we suggest the use of general anesthesia/deep sedation over moderate sedation for therapeutic bronchoscopy.

ACCESS THE FULL GUIDELINE

SUGGESTED APPROACH FOR THE MANAGEMENT OF MALIGNANT CENTRAL AIRWAY OBSTRUCTION



SUGGESTED APPROACH FOR THE MANAGEMENT OF NONMALIGNANT CENTRAL AIRWAY OBSTRUCTION



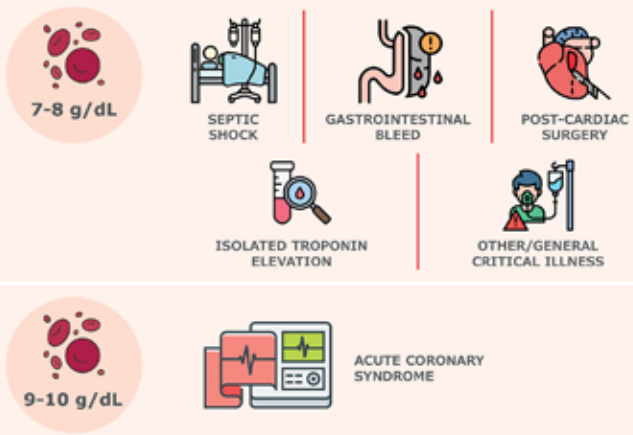
Transfusion of Fresh Frozen Plasma and Platelets in Critically Ill Adults

- In stable nonbleeding critically ill patients with thrombocytopenia and a high risk of spontaneous bleeding, we recommend transfusing platelets if platelet counts fall below 30 to 50 × 109/L.
- In critically ill patients with thrombocytopenia and serious active bleeding, we recommend transfusing platelets if platelet counts fall below 50 x 109/L.
- In critically ill patients with suspected portal hypertension-related gastrointestinal (GI) bleeding due to thrombocytopenia or coagulopathy who are undergoing GI-endoscopy, we suggest against routine platelet or FFP transfusion.

ACCESS THE FULL GUIDELINE

HEMOGLOBIN THRESHOLDS FOR HEMODYNAMICALLY STABLE PATIENTS IN THE ICU

Red Blood Cell Transfusion in Critically Ill Adults: An American College of Chest Physicians Clinical Practice Guideline



Last updated February 3, 2025

EBUS Transbronchial Needle Samples

- In patients with suspected malignant disease undergoing EBUS-TBNA, we suggest utilizing rapid on-site evaluation over usual care.
- In patients with suspected malignant disease undergoing EBUS-TBNA, we suggest using a smaller needle (21 gauge or 22 gauge) over a larger needle (19 gauge).
- In patients with suspected malignant disease undergoing EBUS-TBNA, we recommend performing four or more needle passes instead of three or less needle passes.

ACCESS THE FULL GUIDELINE

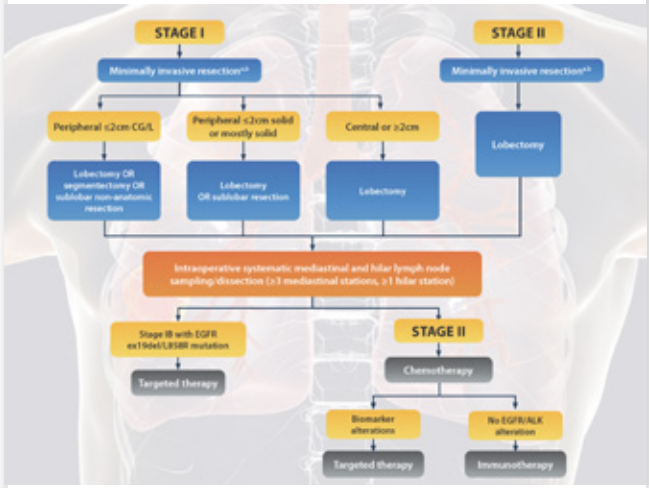
Management of Patients With Early-Stage Non-Small Cell Lung Cancer

ACCESS THE FULL GUIDELINE

- In patients with clinical stage I NSCLC, we recommend minimally invasive approaches over thoracotomy.
- In medically fit patients with clinical stage I NSCLC tumors that are centrally located or > 2 cm, we recommend lobectomy over sublobar resection.
- In medically fit patients with clinical stage II NSCLC, we recommend lobectomy over sublobar resection.
- For patients with completely resected stage II NSCLC, we recommend treatment with adjuvant chemotherapy.

ALGORITHM FOR PATIENTS WITH AVERAGE RISK

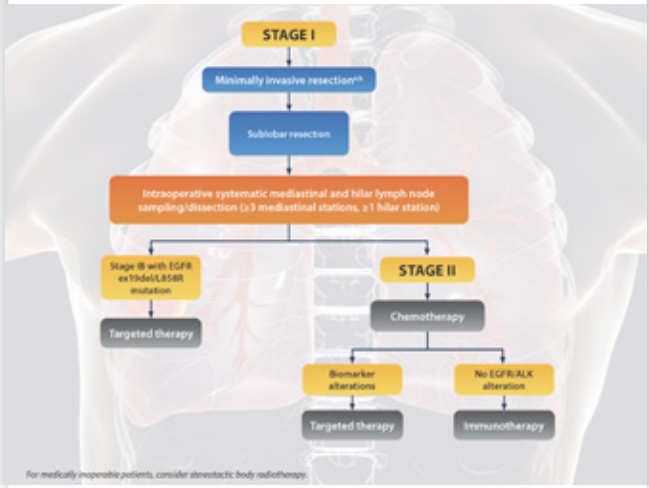
This flowchart outlines an algorithm for management of Stage I and II non-small cell lung cancer in patients with an average operative risk.



https://doi.org/10.1016/j.chest.2025.06.023

ALGORITHM FOR PATIENTS WITH HIGH RISK

This flowchart outlines an algorithm for management of Stage I and II non-small cell lung cancer in patients with a high operative risk.



https://doi.org/10.1016/j.chest.2025.06.023

JUST PUBLISHED:

Biologic Management in Severe Asthma for Adults

ACCESS THE FULL GUIDELINE

IN THE COMING MONTHS, EXPECT TO SEE GUIDELINES ON:

- OSA in Pregnancy
- Management of Bronchiectasis
- Renal Replacement Therapy in the ICU

Pleural disease clinic

// continued from page 11

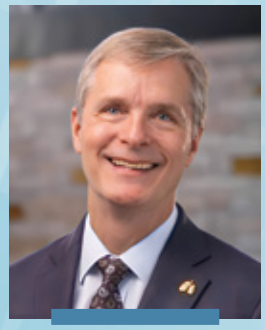
clinics in settings where proper training, standardized protocols, and ultrasound resources are available.[7]

Adult-gerontology acute care nurse practitioners (AGACNPs) are advanced practice nurses with education and training in the treatment of complex health conditions in adults across acute, critical, and chronic care settings.[5] Their scope of practice encompasses stabilizing patients who are acutely ill, managing chronic illnesses, and providing palliative and end-of-life care. AGACNPs are also qualified to perform nearly all diagnostic and therapeutic procedures traditionally carried out by physicians.[3]

EXPANDING ACCESS

Growing patient volume has supported the expansion to a second pleural clinic. Despite this success, barriers to APP autonomy persist across many institutions. Limitations such as the inability to independently obtain informed consent can affect workflow efficiency, particularly in high-volume procedural settings. These challenges highlight the need for ongoing institutional support to optimize APP practice and reinforce the vital role of APPs in bridging care gaps, improving access, and enhancing outcomes through multidisciplinary collaboration. Even with these challenges, the experience illustrates the critical role APPs play in pulmonary medicine to fill gaps in care, expand access, and improve patient outcomes in subspecialty practices and team-based care models. This process truly highlights the success of multidisciplinary care in pulmonary medicine and exemplifies how these teams can better care for complex diseases.

By identifying a gap in care, advocating for system-level change, and pursuing the necessary training to develop procedural competence, I contributed to establishing a service that addresses patient needs while strengthening the capabilities of the IP team. This experience reflects how APPs can address gaps in care, improve access, and strengthen team-based delivery models in subspecialty practices. ●



The journey ahead

Setting goals for the centennial

BY JOHN HOWINGTON, MD, MBA, FCCP

As CHEST President John Howington, MD, MBA, FCCP, wraps up his term, he took some time to answer five questions about the present and future of CHEST.

WHAT ARE THE THREE MOST IMPORTANT ISSUES IN CHEST MEDICINE?

First, substantial funding cuts for medical research, which will have a compounding effect over time, stalling the great advances in science that lead to cures like those achieved with cystic fibrosis. Second, significant cuts to Medicaid, which negatively impact vulnerable patient populations, including critical access and the rural hospitals that care for them. Third, lack of federal government support of proven vaccines to reduce infectious respiratory illness.

HOW DOES CHEST MEMBERSHIP HELP MEDICAL PROFESSIONALS NAVIGATE THESE ISSUES?

CHEST works in partnership with like-minded health care associations to advocate for our members and the patients they care for in their practices. CHEST is a trusted source of the best evidence for optimal patient care in chest medicine.

WHAT IS CHEST DOING TO MAKE AN IMPACT IN THE COMING DECADE?

CHEST continuously works to innovate and improve its educational materials to meet the needs of all providers of chest medicine. There is an ever-increasing depth and breadth of new medical knowledge that one individual cannot assimilate alone. CHEST works to prioritize and package that information for our members so they feel confident they are providing state-of-the-art care for their patients.

WHAT IS CHEST DOING TO PROTECT AND NOURISH THE INCOMING WORKFORCE?

We offer educational products to meet the needs of varied learning styles. We offer traditional in-person educational sessions like Board Review and the CHEST Annual Meeting. In addition, we offer online access to those events, as well as to additional educational tools like the CHEST SEEK® Library, CHEST Curriculum Pathways, and CHEST MedCast. We also offer hands-on simulation courses at our headquarters in Glenview, Illinois.

WHAT ARE CHEST'S GOALS LEADING UP TO ITS CENTENNIAL IN 2035?

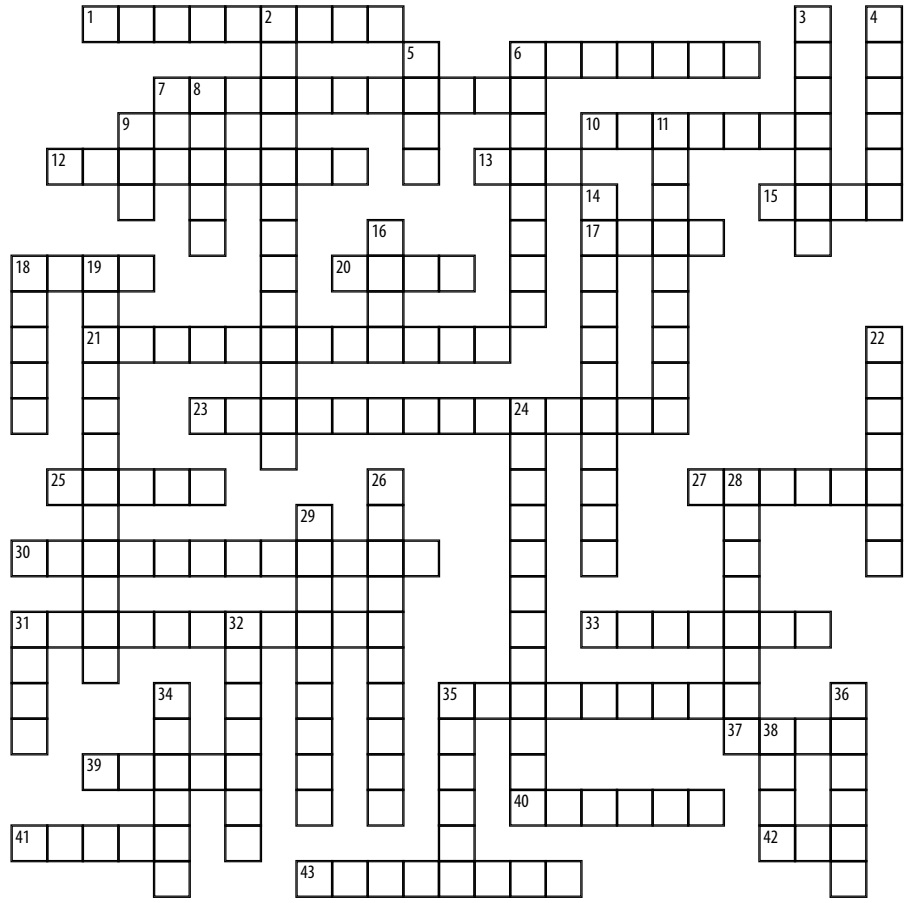
CHEST should be the go-to source for the entire team of providers, not just physicians, in the chest medicine space. Care of patients with chest diseases is a team effort, and we are the association dedicated to providing the best, cutting-edge education to the whole team.

Dr. Howington and CHEST 2025 Scientific Program Committee Chair Sandhya Khurana, MD, FCCP, help hand out souvenir T-shirts during the recent annual meeting in Chicago.

John Howington, MD, MBA, FCCP
President, American College of Chest Physicians

CHEST Puzzler

Test yourself with these clues from the July, August, and September 2025 issues of the journal *CHEST*®—compiled by William Kelly, MD, FCCP.



Scan QR code on page 3 for answer key

ACROSS

1. Journal *CHEST* vision is to be the most _____ source of clinically relevant research. Aretha Franklin would agree that is important (Jul p.3)
6. As with obesity and smoking, a greater consumption of _____ has been associated with poorer COVID-19 outcomes (Sep p.590)
7. Pleural fluid PF-3 criteria to identify exudates includes a value >55 mg/dL of this (Sep p.835)
10. To be a true PRO, you should appreciate the importance of _____ -reported outcomes as end points in clinical trials (Aug p.299)
12. Antagonists to this H in the REHAB-PH trial did NOT improve pulmonary hypertension outcomes… which gave me heartburn (Jul p.10)
13. Time it takes, in minutes, to do the test, which is the most common end point in pulmonary hypertension trials (Jul p.13)
15. Patients with COPD and CT scans showing mucus plugs in four or more lung segments had _____ times the risk of a moderate to severe exacerbation in the following two years (Sep p.635)
17. In patients who are critically ill, ventilator PEEP >10 may lead to an _____ -estimate of wedge pressure during right heart catheterization (Sep p.765)
18. Instruct your patients to inhale "_____ and steady" for a pressurized metered-dose inhaler, "hard and fast" for a dry powder inhaler, and "normal" when using a nebulizer (Aug p.408)
20. Patients with _____ syndrome have a chromosome 21 addition, which occurs 1 in 700 births, and are at risk for sleep-disordered breathing and ILD (Jul p.101)
21. CHEST early-stage lung cancer clinical practice guidelines recommend adjuvant _____ after completely resecting stage II disease (Sep p.810)
23. Crohn's disease and ulcerative colitis have been linked to this irreversible airway dilation, inflammation, and mucus production (Aug p.318)
25. In 1979, 23% of medical graduates were _____. Now it is 52% (Jul p.6)
27. _____ reticularis is an ischemic dermopathy characterized by macular, violaceous, reticular, netlike mottling of the skin with central clearing (Aug p.347)
30. CT-guided lung biopsy is associated with this complication up to 18% of the time; 6% require intervention (Jul p.237)
31. Global survey suggests clinicians had low agreement on utility of PET scan in this nonnecrotizing granulomatous disease but high agreement when it came to cardiac involvement (Jul p.146)
33. In a randomized crossover study, peripheral nodule biopsy with navigation bronchoscopy had a better diagnostic yield if done with both needle and _____ (Jul p.236)
35. Pancreatitis and rupture of this body structure may result in elevated pleural fluid amylase (Sep p.832)
37. In the last five years, 35,000 adults have had this ICU out-of-body lung failure therapy [acronym] at approximately 600 centers worldwide (Sep p.640)
39. Journal *CHEST* color for the Diffuse Lung Disease section tab may indicate we need to go out there and do better… (Jul p.136)
40. _____ cell disease is an inherited blood disorder characterized by chronic hemolysis, organ damage, and painful acute exacerbations. An estimated 100,000 Americans are affected (Aug p.359)
41. The trachea and mainstem bronchi are formed during the _____ trimester of pregnancy (Jul p.96)
42. Measuring small fragments of this, the body's instruction manual, in the blood has been called a new era in pulmonary medicine (Sep p.581)
43. A third of transplant patients experience this post-op. Frailty, environmental factors, and preexisting cognitive decline are predictors (Aug p.438)

DOWN

2. The incidence of coronary artery _____ on lung cancer screening CT scans, according to a literature review, ranges from 14.8% to 98%! (Sep p.719)
3. Natural compound with a cooling sensation when inhaled, unfortunately used in cigarettes, may be helpful on its own in reducing exertional dyspnea for patients with COPD (Aug p.391)
4. CHEST clinical practice guidelines advise against routine platelet and FFP transfusion for thrombocytopenia/coagulopathy ahead of many ICU procedures but does suggest them if about to do a _____ puncture (Sep p.662)
5. Cuff _____ tests prior to extubation have a pooled sensitivity of 0.66 and pooled specificity of 0.88 at predicting reintubation (Jul p.4)
6. Hermansky-Pudlak syndrome is associated with pulmonary fibrosis and characterized by this oculocutaneous finding (Jul p.156)
8. The inside cover of the September *CHEST* issue lists simulation courses offered in December, including one on national board preparation for ultrasound of this organ
9. Atomoxetine and aroxybutynin are part of a growing list of medications to treat this condition [acronym], for which standard of care is noninvasive positive pressure ventilation (Jul p.224)
11. T in the STOP-BANG sleep apnea screening questionnaire (Aug p.521)
14. Airway sarcoidosis has been described as having this appearance, a type of natural round rock used to pave roads (Sep p.689)
16. For patients that are ready for extubation but are without air movement around endotracheal tube when balloon is down, systemic steroids _____ hours before extubation is suggested (Jul p.5)
18. In a systematic review, 40% of patients getting PFTs with lung cancer screening had airflow obstruction and _____ + 5% of them had never been diagnosed (Jul p.68)
19. _____ has some advantages over traditional spirometry, including increased sensitivity, it is not effort-dependent, and its sound waves can measure elastic and inert lung tissue properties (Aug p.284)
23. Pleural fluid protein > 7g/dL may suggest this plasma cell blood cancer (Sep p.831)
24. More than 5% mesothelial cells in pleural fluid make this infection unlikely (Sep p.831)
26. By 2050, the population age >65 will likely double, so it is expected that the number of older patients getting this ultimate treatment for irreversible lung disease will too (Aug p.436)
28. Looking at 12,000 in-training exams, researchers found a slight _____ in fellows' scores during the outbreak of the COVID-19 pandemic. Impact on other domains not yet known (Sep p.568)
29. Forssmann experimented with right heart catheterization in 1929. What was name of the patient? (Sep p.764)
31. Most common organ effected by malignancy after lung transplant (Aug p.443)
32. The most common and debilitating symptom of COPD (Aug p.391)
34. Lung development continues until around age _____, with alveoli increasing from 20 million at birth up to 300 million to 800 million (Jul p.96)
35. A "triple-blind" journal article review means that this person in addition to the author and reviewer is masked to the identity of the others (Jul p.161)
36. What was the most common spirometry pattern found in a cohort of 253 patients with sarcoidosis (tricky!) (Sep p.689)
38. The BOREAS and NOTUS trials showed decreased exacerbations in patients with _____ and type 2 inflammation using dupilumab (Jul p.57)

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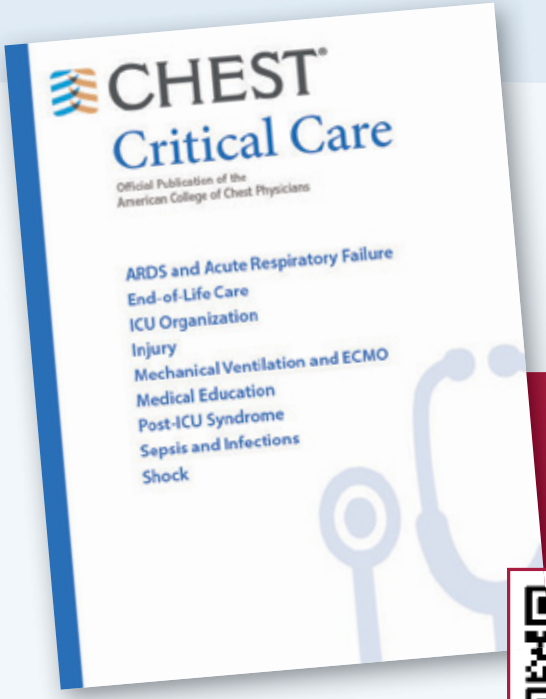

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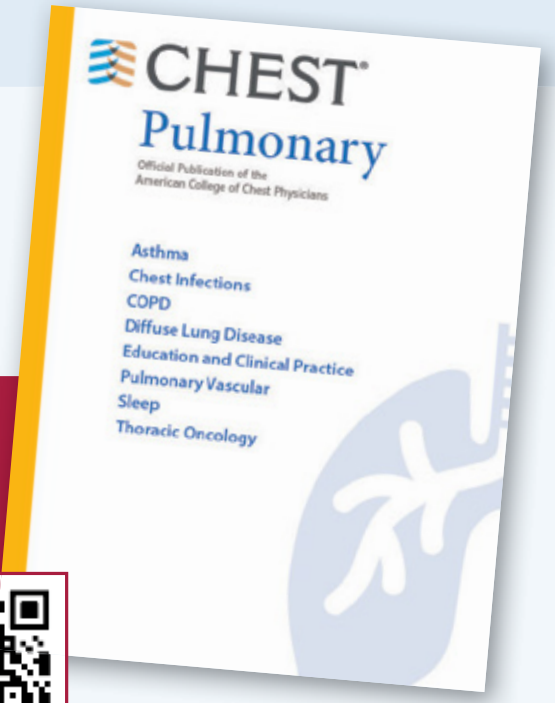

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