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Career Guide

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The NEW ENGLAND JOURNAL of MEDICINE

October 6, 2023

Dear Physician:

As a resident nearing completion of your training, I'm sure that finding the right employment opportunity for you is a top priority. The *New England Journal of Medicine* (NEJM) is the leading source of information about job openings, especially practice opportunities, in the country. To assist you in this important search, enclosed is a complimentary copy of the 2023 *Career Guide: Residents and Fellows* booklet, containing current physician job openings across the country, and a couple of recent selections from our Career Resources section of NEJMCareerCenter.org.

Designed specifically based on advice from your colleagues, the NEJM CareerCenter website offers physician users many confidentiality safeguards that keep your personal information and job searches private. Physicians have the flexibility of looking for both permanent and locum tenens positions in their chosen specialties and desired geographic locations.

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On behalf of the entire *New England Journal of Medicine* staff, please accept my wishes for a rewarding career.

Sincerely,

Eric J. Rubin, MD, PhD

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NEJM GROUP

Hospitalist Update: For Hospital Medicine Physicians, Emerging Opportunities Plentiful in Clinical and Operational Realms

By Bonnie Darves

Hospital medicine has made a lot of headway for a relatively new physician specialty. In just over 25 years, hospitalists have integrated themselves into virtually every aspect of care delivery in hospitals and health systems. From their beginnings as in-hospital internists and family medicine physicians managing the inpatient care of community primary care physicians' patients, a vital role that persists today, hospitalists are now serving in top leadership positions, commandeering quality improvement initiatives, and developing facility-wide protocols. They're also comanaging specialists' patients and delving deep into hospital operations and IT infrastructures to help facilitate systems improvements.

For young physicians contemplating where they'll hang their stethoscopes, that broad swath of practice possibilities is a large part of the specialty's appeal, according to Rohit Uppal, MD, MBA, chief clinical officer for TeamHealth Hospitalist Services in Orlando, Florida. "The lure of hospitalist practice is that physicians are exposed to aspects of medicine that they might not encounter elsewhere and also have the opportunity to learn leadership skills on the job," Dr. Rohal said. "There's really no other specialty that exposes you to the breadth of medicine."

For example, hospitalists may work with colleagues in the ER and critical care, cardiology, neurology, orthopedics, and, in limited cases, trauma specialists, Dr. Rohal said. In a newer role, serve as physician advisers assessing the status of and optimal care setting for an even broader range of patients.

Increasingly, Dr. Rohal said, hospitalists are also integrally involved in managing transitions of care and the systems issues that challenge hospitals. Hospitalists are moving into informatics, quality improvement (QI), care management, telehealth, and services utilization. "The possibilities, in terms of career paths for hospitalists, are robust — and growing. Hospitalists were already being viewed as leaders in the hospital before the pandemic hit. Their impressive performance during COVID-19 cemented that," said Dr. Rohal, whose company employs approximately 3,000 hospitalists at 200 U.S. sites.

Jerome C. Siy, MD, a past president of the Society of Hospital Medicine and division medical director of hospital-based specialties for HealthPartners in Minneapolis, Minnesota, agrees that hospitalists' role in helping hospitals navigate the pandemic has revealed even more ways, particularly in telehealth, that hospital medicine physicians' expertise might bring value. Today, Dr. Siy said, hospitalists are being tapped for key roles in operations — improving electronic health records (EHRs) and consulting on informatics innovations. "We're even seeing hospitalists getting involved in emerging areas such as predictive analytics, patient risk scoring, population health, and nascent hospital-at-home programs," he said.

> "As an early-career hospitalist, you have to invest in growing your knowledge base and carving out time to do committee work if you want to pursue a leadership role. There are new skill sets to learn, and that takes time."
>
> — Jerome C. Siy, MD, HealthPartners

Per Danielsson, MD, a hospitalist who has helped hospitals pilot hospital-at-home (HAH) programs, which seek to provide hospital-level care for older patients who may be at risk for functional decline or other problems associated with long inpatient stays if they remain in the hospital. He views the model as a win-win for hospitals and the hospitalists who clinically manage such patients. Hospitalists bring valuable experience to HAH programs because of their extensive expertise in triaging acutely ill patients, working in multidisciplinary teams, and, recently, delivering telemedicine. In a June 2019 article in the *Journal of Hospital Medicine*, Dr. Danielsson predicted that HAH hospitalists might one day become a subspecialty of their own.

In a field that continues to grow steadily, and at a time when hospitals are amenable to placing talented hospitalists in just about any administrative role they're interested in, there's no shortage of both traditional practice opportunities and jobs that combine clinical and administrative work. Today, an estimated 50,000 hospitalists practice in the United States, and the specialty experienced a 50 percent growth rate between 2012 and 2019, according to a study published in *Journal of Hospital Medicine* in August 2022.

What early-career hospitalists are seeking

Even if the sky is the limit in terms of the myriad ways that hospitalists might configure their clinical careers or combine clinical and administrative work, young physicians considering — or newly entering — the field choose the specialty for its schedule flexibility and its perceived ability to deliver acceptable work/life balance. Ijeoma Carol Nwelue, MD, hospitalist medical director for Baylor Scott & White Health in Fort Worth, Texas, said that even early-career hospitalists aren't shy about articulating their wish lists.

"Young physicians really want that work/life balance, so schedules are a big issue for them," she said. "Hospitalists really want their work planned around their life, and they're expecting not to have to grind it out every day. They want specific fixed hours, but they also want some schedule flexibility when they need it."

Most hospitalist organizations are attempting to deliver on both fronts. Still, the predominate schedule in the specialty is seven on/seven off (often called a "7/7") — hospitalists work seven days or nights in a row, followed by seven off — can be a bit of a grind when hospitalists are in the "on" mode, several sources acknowledged. As such, some groups are exploring ways to shorten shifts or otherwise reconfigure schedules. So far, no new standard has emerged.

Young physicians are also looking for ways to serve the community at large. They're increasingly articulating that desire when they interview for positions, observed Dr. Nwelue, now a veteran of the field. "That's something we've been seeing a lot in recent years — young physicians wanting dedicated time for community outreach, for opportunities to care for or teach patients outside of the hospital setting," she said. "It's a common request of this new generation."

Hospitalists want to teach, too

Also high on the wish list for many young hospitalists are formal or informal teaching opportunities. Although hospitalists in academic medicine have such opportunities as a matter of course, many of those practicing in other settings such as community hospitals also want to spend some time teaching students, residents, or even other colleagues, several sources mentioned. Fortunately, some of the hybrid community hospital/academic institution partnerships that have emerged in the past decade are giving hospitalists a chance to do some teaching and research work in addition to their clinical duties.

In the academic realm, some programs are seeking more expedient pathways for early-career hospitalists move into medical education more quickly — with the objective of providing that career satisfier sooner that it might occur traditionally in competitive academic environments. The University of Chicago, for instance, has pioneered an innovative Passport to Clinical Teaching program, which offers early-career hospitalists access to medical-education opportunities that they can pursue on their own time and can coordinate with their clinical responsibilities.

"A lot of young hospitalists really want to teach and to learn how to become mentors, but it's challenging because their schedules are heavy clinically. And there is substantial competition for available teaching time in academic environments," said Elizabeth A. Murphy, MD, assistant professor and director of clinical service development in the University of Chicago's Section of Hospital Medicine. "What we've done is create structured content on becoming a better teacher that hospitalists can access on their own time."

More limited teaching opportunities are available as a series of Passport rotations in various domains, that cohort members complete within about a year, Dr. Murphy noted. Participants typically spend time at external community hospitals that operate smaller residency programs or host medical students and can use extra hands. Cohort members also learn how to develop continuing medical education (CME) offerings, work in community health clinics, and engage in scholarly activities, among other offerings.

J.P. "John" Murray, MD, a young University of Chicago hospitalist who now directs the hospitalist consult service, maintains that his Passport program participation effectively jumpstarted his career. "I really appreciated the fact that the Passport program is geared toward young hospitalists. It provides lots of opportunities to get involved with residents and medical students, that you might not have otherwise," Dr. Murray said. "It provides a framework and exposure. It keeps you sharp, and it provides a way to show leadership that you're very interested in teaching."

The program started in 2020 and has been well received, Dr. Murphy said. Some of the learners in the initial cohort have received teaching awards or moved into formal teaching roles. "Many hospitalists come into academic medicine because of their favorable training experiences and because they want to be part of what academic medicine does," Dr. Murphy said. "This offers early-career hospitalists a way to do that, and it gives us a way to harness the mentoring talent we have."

Telehealth and other practice options

Not surprisingly, because of their varied exposure to many aspects of care delivery and the skills they gained navigating the pandemic, hospitalists have been pivotal in helping hospitals develop and expand telehealth services, to reach both home-bound patients and those in underserved areas. Dr. Siy noted that hospitalists at his organization provide telehealth services at night to outlying hospitals and some reserve a portion of their clinical time to work in rural hospitals.

Dr. Nwelue reported that her organization is piloting a hospitalist-managed telehealth service aimed at managing lower-acuity patients — such as those with infections that require IV antibiotics — who can be safely cared for at home with nursing intervention and hospitalist management. Likewise, in pediatrics, a field that has struggled with capacity as dedicated pediatrics units have shrunk or disappeared, pediatric hospitalists are using telemedicine to expand their reach into rural and smaller hospitals. In particular, pediatric hospitalists are helping such facilities care for lower-acuity young patients that present to their emergency departments.

In recent years, another brand of hospitalist has emerged — transitionalists. These hospitalists focus on the intersection of inpatient care and so-called step-down units. Transitionalists practice either part-time or full-time in post-acute settings such as inpatient rehabilitation facilities, long-term acute-care hospitals, or skilled nursing facilities. In such roles, hospitalists often serve as medical directors.

In another recent development, hospitalists are being tapped as in-house consultants. They're helping hospitals reduce unnecessary services utilization, assess medical-necessity issues, and streamline post-discharge care continuity. Because hospitalists develop in-depth familiarity with specialists' practice patterns, test ordering, and patient lengths of stay, hospitals are discovering that hospitalist input pays dividends in both reducing costs and improving care.

Inside hospitals and health systems, organizations are realizing that young tech-savvy hospitalists can also be instrumental in helping them vexing issues. Hospitalists are being tapped to help resolve workflow, IT, and EHR issues that cause inefficiencies — or clinician frustration. "This is an ideal role for early-career hospitalists who have an interest and some expertise in healthcare technology," said Dr. Siy. "There's a real demand for such skills."

One of the big draws in the early years of hospital medicine was that hospitalists working "7/7" schedules could use some of the off-week time to moonlight at local hospitals, perhaps to pay off education debt more rapidly. Although moonlighting isn't as common as it once was in the field, some hospitalists recognize that they can use their off time to learn new clinical or business skills or even start new ventures.

Mitchell Durante, DO, and Anthony King, DO, hospitalists at BJC Healthcare Christian Hospital in St. Louis, Missouri, recently decided to take advantage of their "7/7" schedule flexibility to start a manipulative medicine clinic that's open during their off weeks. "It took us a few years to get this up and running, but we're excited about starting our own business," Dr. Durante said. "That's one of the good things about hospital medicine — it gives you the flexibility to do something like this."

Some hospitalists are also utilizing their newly developed telemedicine skills with their flexibility to carve out opportunities to provide remote care and consultations from home. Others are developing new products or apps, launching podcasts, or serving an independent medical reviewers.

The other 'ists' — growth of specialty hospitalists is slow, but steady

In the past 15 years, several specialties have made strides in developing inpatient-only services based on the hospitalist model as specialists wrestle with the growing challenges of simultaneously managing a combined outpatient/inpatient practice.

The mainstays of the specialty hospitalist movement remain orthopedics, trauma, anesthesiology, OB/GYN, general surgery, and gastroenterology. But psychiatry and neurology are both increasingly embracing the hospitalist model. In a pioneering venture, the University of California, San Francisco has started a Neurohospitalist Division that utilizes a structure similar to the traditional medicine hospitalist model.

Leadership roles

Although it's not uncommon now to see hospitalists as medical directors, chief medical officers, and health-system committee chairs, young hospitalists should understand that both a learning curve and a willingness to devote extra time to small-scale initiatives are prerequisites for obtaining leadership roles, Dr. Siy noted. "As an early-career hospitalist, you have to invest in growing your knowledge base and carving out time to do committee work if you want to pursue a leadership role. There are new skill sets to learn, and that takes time," he said.

Organizations are trying to accommodate hospitalists' desires to move into leadership roles without waiting a decade or longer. TeamHealth, for example, operates a designated leadership track for interested hospitalists. And it's a popular option, according to Dr. Uppal. In addition, the Society of Hospital Medicine's Leadership Academy offers a wide range of courses that enable hospitalists to obtain leadership and management skills.

> "The possibilities, in terms of career paths for hospitalists, are robust — and growing. Hospitalists were already being viewed as leaders in the hospital before the pandemic hit. Their impressive performance during COVID-19 cemented that."
>
> — Rohit Uppal, MD, TeamHealth Hospital Medicine

For Jessica Porter, MD, a TeamHealth hospitalist medical director at Memorial Hospital Miramar in Hollywood, Florida, the opportunity to lead came early — soon after she completed residency in 2016. She jumped at the chance. "I'd always been interested in leadership, and in contributing, because, well, someone did the same for me. It was a steep learning curve, but I managed it and found I really enjoyed the administrative work," said Dr. Porter.

Today, although Dr. Porter maintains a full clinical schedule, she manages to fit in most of her administrative duties during her "on" weeks, and receives a stipend for her leadership work. Those duties include managing operations and coaching physicians, representing hospitalists' interests at hospital management meetings and, as needed, boosting morale. "It's very gratifying work, and I think it's important to have a seat at the table when [organizational] decisions are being made," she said.

Dr. Porter advises young hospitalists who are interested in leadership to look for committee and task force openings, engage in quality improvement initiatives and, above all, express their interest in leadership roles. "If you don't ask, you don't get it — whether it's a raise or a leadership opportunity," she said.

When Is It Time to Change Jobs?

By Nisha Mehta, MD, *a physician leader whose work focuses on physician empowerment, community building, and career longevity in medicine*

Statistically, the majority of physicians will change jobs within their first five years out of training. Additionally — even at later stages of physician careers — an increasing percentage of the physician population consider changes in their career. Physician turnover is an often talked about issue among hospital administrators and practice owners.

Why is this? Well, part of it has to do with the challenges associated with being a physician in the current health care landscape. My father, a cardiologist, spent four decades of his career with the same group. Many of his friends can say the same. On the other hand, I know a far lower percentage of colleagues who could say with confidence that they see themselves with the same group for the remainder of their careers. Aside from practical drivers of physician turnover, such as a desire to be closer to family or a change in the job of a significant other, many are finding their workplaces increasingly challenging. As consolidation within the health care space increases, physician demographics change, and the pressure to do more with less increases, more physicians find themselves asking if their situation is sustainable.

We all have aspects of our jobs that are pain points, and the expectation that any job will be perfect is unrealistic. How do you know you're not

just trading one set of pain points for another — which in a worst case scenario, is potentially worse elsewhere?

When considering a job change, I always recommend writing down the pain points at your current job, delineating which ones are dealbreakers, and which ones could potentially be changed if discussed openly with the employer. If you are planning on leaving anyways, it's advisable to first see if the current situation can be fixed. Although these conversations can be uncomfortable, ultimately if you're planning on leaving regardless, it may be that there's little to lose in trying. Similarly, ensuring that these same pain points are not present at the new job is prudent.

Factors such as salary, flexibility in work hours, opportunities for growth or promotion, dissatisfaction with the current job environment and the direction a company is going in, burnout, or other non-salary aspects of the compensation package are all examples of things that lead to job turnover that could potentially be negotiated with the current employer.

There are other factors which many see as writing on the wall that a change is inevitable. Sometimes these can be related to changes in ownership or management structure of a group, a confirmed trend toward cutting physician compensation or hiring patterns that suggest the physician's time at the job is limited, or administrative mandates that have been challenged and upheld, which leave the physician with the conclusion that they can't practice medicine in a way that they enjoy or feel is best for the patient.

Many people stay with jobs out of comfort or fear of change. Unfortunately, this leads to burnout, and ultimately is a threat to career longevity. If you're feeling unhappy with your job, it's time to either advocate for change within your current position, or consider other options.

CLINICAL PRACTICE

Patrick G. O'Malley, M.D., M.P.H., *Editor*

Community-Acquired Pneumonia

Thomas M. File, Jr., M.D., and Julio A. Ramirez, M.D.

This Journal *feature begins with a case vignette highlighting a common clinical problem. Evidence supporting various strategies is then presented, followed by a review of formal guidelines, when they exist. The article ends with the authors' clinical recommendations.*

A 66-year-old man with underlying chronic obstructive pulmonary disease (COPD) presents to the emergency department with a 2-day history of fever, dyspnea, and cough productive of green, purulent sputum. He had noted increasing dyspnea 3 days before the onset of fever. He describes one episode of acute exacerbation of COPD that occurred 6 months earlier. The physical examination is notable for mild respiratory distress and confusion, with disorientation to time. His temperature is 38.6°C, heart rate 100 beats per minute, blood pressure 140/85 mm Hg, respiratory rate 24 breaths per minute, and oxygen saturation 92% while he is breathing ambient air. Auscultation of the lungs reveals coarse rhonchi over the right midlung field. Chest radiography reveals right upper-lobe consolidation (Fig. 1). His white-cell count is 14,000 per cubic millimeter, platelet count 159,000 per cubic millimeter, serum sodium 136 mmol per liter, blood urea nitrogen 19 mg per deciliter (6.8 mmol per liter), creatinine 1.1 mg per deciliter (97.2 μmol per liter), and procalcitonin 5.4 ng per milliliter (normal range, 0.00 to 0.05). A multiplex viral panel was positive for respiratory syncytial virus. How would you further evaluate and treat this patient?

From the Division of Infectious Disease, Summa Health, Akron, and the Section of Infectious Disease, Northeast Ohio Medical University, Rootstown — both in Ohio (T.M.F.); and Norton Infectious Diseases Institute, Norton Healthcare, and the Division of Infectious Diseases, University of Louisville — both in Louisville, KY (J.A.R.). Dr. File may be contacted at filet@summahealth.org or at Summa Health, 75 Arch St., Suite 506, Akron, OH 44304.

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CME at NEJM.org

THE CLINICAL PROBLEM

Community-acquired pneumonia is an acute infection of the pulmonary parenchyma in a patient who has acquired the infection in the community (as distinguished from an infection acquired in a hospital). In the United States, community-acquired pneumonia is one of the leading causes of hospitalization and death, with approximately 6 million cases reported each year.[1-6] The annual incidence of hospitalization for community-acquired pneumonia in the United States is approximately 650 adults per 100,000 population, corresponding to 1.5 million unique hospitalizations for the disease each year.[6] Factors that increase the risk of community-acquired pneumonia include advanced age, chronic lung disease, chronic heart disease, cardiovascular disease, diabetes mellitus, malnutrition, viral respiratory tract infections, immunocompromising conditions, and lifestyle factors such as smoking and excessive alcohol consumption.

The development of pneumonia is influenced by a combination of factors, including host susceptibility, pathogen virulence, and the inoculum of microorganisms reaching the lower airways. Respiratory pathogens must overcome several defense mechanisms of the respiratory system before reaching the alveoli. These defenses include mucus trapping, mucociliary clearance, coughing, and swallowing. Pathogens can reach the alveoli by means of microaspiration (aspiration of small amounts of oropharyngeal secretions that often occurs during sleep), inhalation, macroaspira-

KEY CLINICAL POINTS

COMMUNITY-ACQUIRED PNEUMONIA

- The diagnosis of community-acquired pneumonia is made on the basis of compatible symptoms and signs, with evidence of a new infiltrate on an imaging study.
- Most outpatients with mild community-acquired pneumonia can be treated empirically without diagnostic testing for bacteria. However, testing for SARS-CoV-2 and influenza should be considered.
- A comprehensive approach to microbiologic testing for hospitalized patients is recommended for determining the appropriate pathogen-directed therapy.
- The choice of antimicrobial therapy for community-acquired pneumonia varies according to severity, coexisting conditions, and the likelihood of antimicrobial-resistant organisms.

tion (aspiration of a large amount of oropharyngeal or upper gastrointestinal contents), or hematogenous spread. Microaspiration is the primary path for microorganisms into the lungs, and macroaspiration may lead to aspiration pneumonia.[7] The alveolar macrophage is the primary defense mechanism in the lung. The lung microbiome may also contribute to defense mechanisms by producing antimicrobial molecules or competing for nutrients.[8]

If pathogens overcome the alveolar defense mechanisms, they will multiply and cause local tissue damage. Injured host cells then produce damage-associated molecular patterns that further stimulate alveolar macrophages to produce cytokines and chemokines, triggering a local inflammatory response. Cytokine spillover into the bloodstream produces a systemic inflammatory response. The local and systemic inflammatory responses constitute a physiologic response to lung infection. The inflammatory responses explain most of the host patient's signs and symptoms as well as laboratory and imaging abnormalities (Fig. 2). In some patients, the initial systemic inflammatory response can become dysregulated and result in tissue injury and eventual organ dysfunction.[9]

Numerous microorganisms can cause community-acquired pneumonia. The bacteria and viruses that are considered to be likely etiologic agents in all patients with community-acquired pneumonia are described as core respiratory pathogens (Table 1).[10-12] Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is now a predominant viral pathogen in patients with community-acquired pneumonia. Uncommon or infrequent causes of community-acquired pneumonia should be considered as likely agents in patients who present with risk factors for a particular pathogen (e.g., travel or animal exposure) (Table S3 in

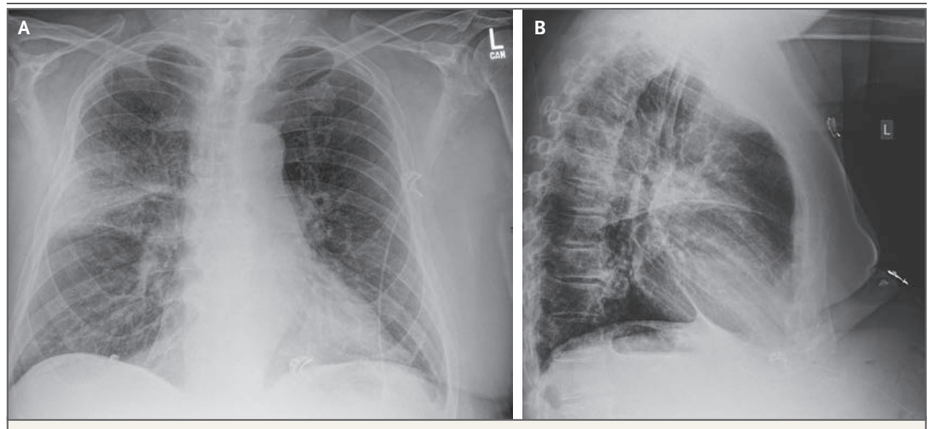

Figure 1. Chest Radiographs.
Posteroanterior (Panel A) and lateral (Panel B) views show right upper-lobe infiltrate.

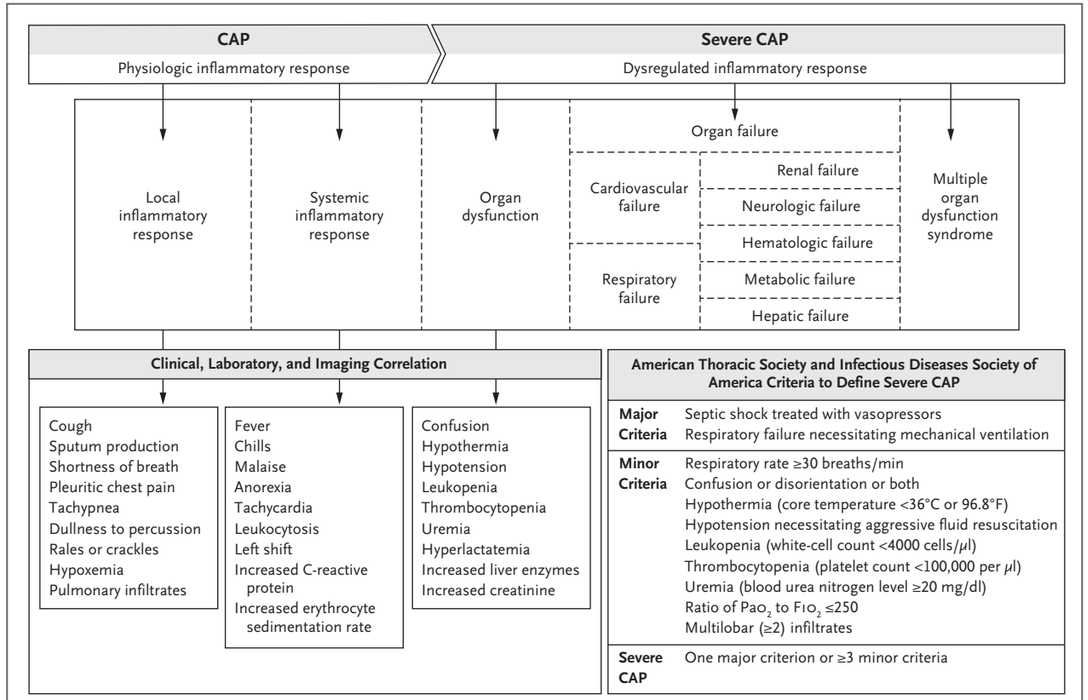

Figure 2. Pathogenesis of Community-Acquired Pneumonia (CAP) with Corresponding Clinical, Laboratory, and Imaging Abnormalities.
PaO_2 denotes partial pressure of arterial oxygen, and FIO_2 the fraction of inspired oxygen.

the Supplementary Appendix, available with the full text of this article at NEJM.org) or in special populations, such as immunocompromised patients (Table 1).[12]

Although community-acquired pneumonia has traditionally been viewed as an acute disease of the lungs, the current understanding is that it is a multisystem disease that can result in acute and long-term sequelae (Fig. 3).[13,14] Community-acquired pneumonia is associated with substantial long-term illness and death, with death at 1 year occurring in approximately 30% of all hospitalized patients and in approximately 50% of patients whose conditions had resulted in admission to the intensive care unit (ICU).[6,15]

STRATEGIES AND EVIDENCE

DIAGNOSIS AND EVALUATION

The diagnosis of community-acquired pneumonia is made on the basis of infiltrates shown on a chest radiograph (or on computed tomography in a patient with symptoms if a chest radiograph is negative), plus supporting symptoms, signs consistent with airspace disease (e.g., rales, rhonchi, or egophony), or laboratory abnormalities resulting from the local and systemic inflammatory responses (Fig. 2). Testing for the inflammatory biomarker procalcitonin may supplement clinical judgment with regard to diagnosis and course of bacterial community-acquired pneumonia, since synthesis of procalcitonin is triggered by specific cytokines in response to bacteria. Although the procalcitonin level is typically elevated in bacterial community-acquired pneumonia, it is low in viral community-acquired pneumonia. Procalcitonin levels quickly decline with the resolution of bacterial infection, a response that can inform the decision to discontinue treatment with antimicrobials.[16-18] However, procalcitonin levels are not definite indicators, since false positives can occur (e.g., in hemorrhagic shock or kidney injury),

Table 1. Respiratory Pathogens in Community-Acquired Pneumonia (CAP).*

Pathogen Group	Pathogen
Common or core	
Gram-positive bacteria	*Streptococcus pneumoniae*, methicillin-susceptible *Staphylococcus aureus*, *Strep. pyogenes*, other streptococci
Gram-negative bacteria	*Hemophilus influenzae*, *Moraxella catarrhalis*, Enterobacteriaceae (e.g., *Klebsiella pneumoniae*)
Atypical bacteria	*Legionella pneumophila*, *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*
Respiratory viruses	Influenza virus, SARS-CoV-2, respiratory syncytial virus, parainfluenza virus, human metapneumovirus, rhinoviruses, common human coronaviruses
Uncommon or infrequent	
Gram-positive bacteria	Methicillin-resistant *Staph. aureus*, nocardia species, *Rhodococcus equi*
Gram-negative bacteria	Enterobacteriaceae, including extended-spectrum beta-lactamases or carbapenem-resistant enterobacteriaceae; nonfermenting bacilli (e.g., pseudomonas or acinetobacter); *Francisella tularensis*
Atypical bacteria	*Chlamydia psittaci, Coxiella burnetii*
Mycobacteria	*Mycobacterium tuberculosis*, nontuberculous mycobacteria
Viruses	Cytomegalovirus, herpes simplex, varicella zoster, MERS-CoV
Fungi	*Pneumocystis jirovecii*, aspergillus species, mucorales species, histoplasma species, cryptococcus species, blastomyces species, coccidioides species
Parasites	*Strongyloides stercoralis*, *Toxoplasma gondii*

* Risk factors associated with specific pathogens are shown in Table S3. MERS-CoV denotes Middle East respiratory syndrome coronavirus, and SARS-CoV-2 severe acute respiratory syndrome coronavirus 2.

and some bacteria (e.g., mycoplasma) may cause pneumonia in patients with normal procalcitonin levels. If access to chest radiography is limited, a diagnosis can be suggested by the findings from a comprehensive examination, including evidence of lung consolidation. Community-acquired pneumonia is considered to be severe if there are manifestations of organ dysfunction or organ failure. The American Thoracic Society and Infectious Diseases Society of America (ATS–IDSA) criteria for defining severe community-acquired pneumonia are shown in Figure 2.[1]

SITE OF CARE

The decision regarding the site of care depends on many variables, including severity of illness, associated disease, presence of hypoxemia, adequacy of home support, and probability of adherence to treatment. The severity of a patient's illness is primarily a determination based on clinical judgment, which can be supplemented by the use of severity scores. The most commonly used severity scores are the Pneumonia Severity Index (PSI) and CURB-65, a score that incorporates confusion, urea, respiratory rate, blood pressure, and age ≥65 years.[19,20] Calculations for determining PSI scores are provided in the Supplementary Appendix. The CURB-65 scale ranges from 0 to 5; scores are calculated by assigning 1 point each for the presence of new-onset confusion, blood urea nitrogen level greater than 19 mg per deciliter, respiratory rate greater than 30 breaths per minute, systolic blood pressure less than 90 mm Hg or diastolic blood pressure less than 60 mm Hg, and age of 65 years or older. Outpatient treatment is recommended for a patient with a CURB-65 score of 0 or 1, a short hospital stay or close observation should be considered for a patient with a score of 2, and hospitalization is recommended for a patient with a score of 3 to 5. Indications for ICU care are based on further criteria, including the use of mechanical ventilation and the presence of shock (Fig. 2). Severity score thresholds have not been defined for the treatment of patients who are immunocompromised; thresholds for admission should be based on clinical judgment.[12]

MICROBIOLOGIC TESTING

The identification of the causative agents of community-acquired pneumonia was limited in the past because there were no rapid, easily performed, accurate, and cost-effective methods of obtaining results for most patients at the point of service. However, molecular diagnostic techniques that combine sensitivity, specificity, and a rapid turnaround time are becoming increasingly available.[21-23] The coronavirus disease 2019 (Covid-19) pandemic has illustrated the etiologic importance of respiratory viruses that are primarily identified by molecular testing.

Microbiologic testing for bacterial causes is generally not recommended for most patients who are treated in ambulatory settings, since empirical antibiotic therapy is largely successful. However, testing for viruses (e.g., SARS-CoV-2 and influenza) should be considered, since the results can affect the choice of therapy. Establishing an etiologic diagnosis of community-acquired pneumonia in hospitalized patients is important for several reasons, including the appropriate selection of an antibiotic for use against a specific pathogen, promote good antimicrobial stewardship, and allow identification of pathogens associated with notifiable diseases such as SARS-CoV-2 infection or legionnaires' disease. Available recommended tests include sputum Gram's staining and culture, blood cultures, urine immunochromatographic analysis for *Streptococcus pneumoniae* and *Legionella pneumophila* serogroup 1, and molecular techniques such as multiplex assays that include SARS-CoV-2. In addition, if there is a risk of methicillin-resistant *Staphylococcus aureus* (MRSA) infection, obtaining a nasal swab for a MRSA polymerase-chain-reaction (PCR) assay can be useful, since a negative result can allow for discontinuation of anti-MRSA therapy.[24] A more comprehensive microbiologic workup should be performed on the basis of epidemiologic exposures as well as individual patient characteristics such as immunosuppression.[12]

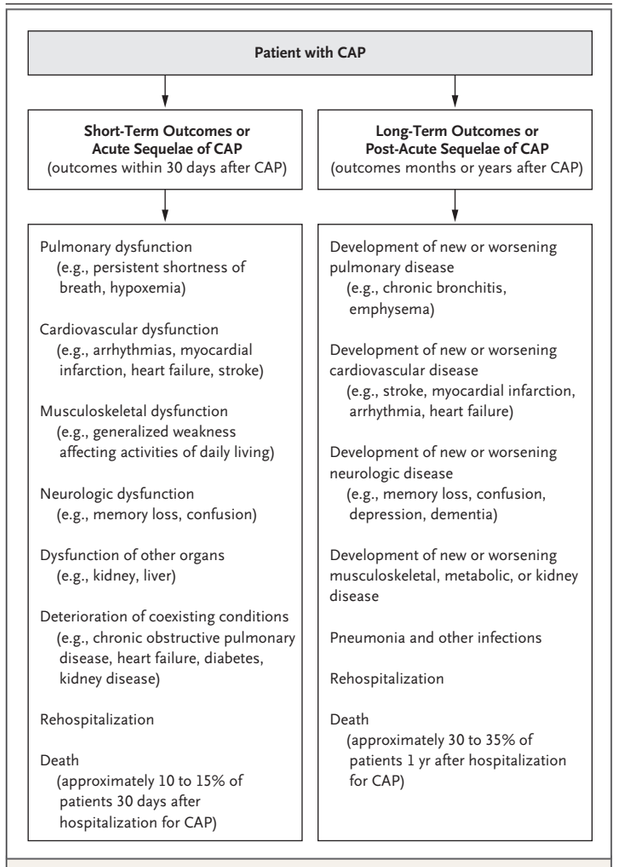

Figure 3. Potential Clinical Outcomes of CAP.

TREATMENT

Empirical antimicrobial therapy targets common pathogens on the basis of risk factors.[1] Antiviral therapy for influenza or SARS-CoV-2 infection should be administered according to clinical factors, the results of diagnostic tests, or both.[1,25] Therapy should be administered as soon as possible after community-acquired pneumonia is diagnosed. Therapy for patients who are immunocompromised is beyond the scope of this article and has been described elsewhere.[12]

Ambulatory Patients

For most patients who are younger than 65 years of age, otherwise healthy, and have not recently received treatment with antibiotics, recent ATS–IDSA guidelines recommend one of the following three oral medication options: amoxicillin (1 g three times daily), doxycycline (100 mg twice daily), or a macrolide (azithromycin at a dose of 500 mg on day 1, then 250 mg daily, or clarithromycin at a dose of 500 mg twice daily [extended-release, 1000 mg daily]). Macrolides should be considered only in areas where pneumococcal resistance to macrolides is less than 25% — which excludes the United States, where resistance exceeds 30%.

For patients who have taken antibiotics within the past 3 months, have serious coexisting conditions (e.g., chronic heart, lung, kidney, or liver disease; diabetes mellitus; or alcohol dependence), or who are smokers, amoxicillin–clavulanate (875 mg orally twice daily [extended-release, 2 g twice daily]) and either a macrolide (preferred) or doxycycline are recommended. Patients who cannot take beta-lactam agents owing to hypersensitivity or adverse effects can instead be treated with a respiratory fluoroquinolone (levofloxacin at a dose of 750 mg daily or moxifloxacin at a dose of 400 mg daily) or one of two more recently approved agents, lefamulin or omadacycline.[26,27]

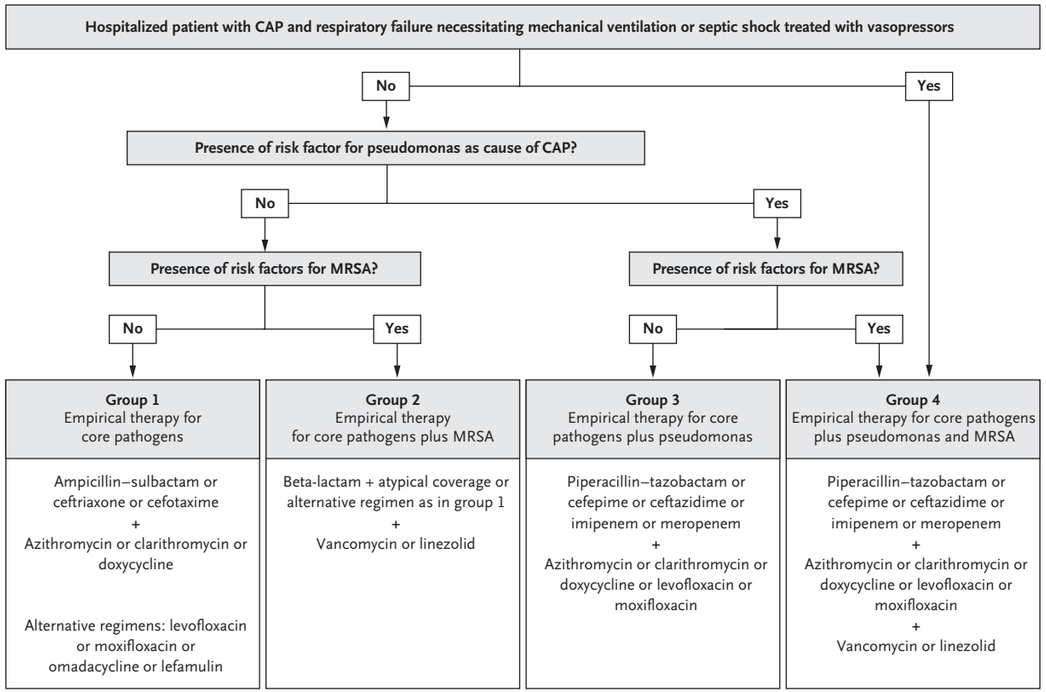

Figure 4. Empirical Therapy for Hospitalized Patients with CAP.

In the presence of severe CAP with respiratory failure necessitating mechanical ventilation or shock treated with vasopressors, initial therapy against methicillin-resistant *Staphylococcus aureus* (MRSA) and pseudomonas can be considered, pending assessment for risk factors and subsequent microbiologic test results. Strong risk factors for pseudomonas include known colonization or previous infection and gram-negative bacilli on Gram's staining; weak risk factors include receipt of intravenous (IV) antibiotics in the previous 3 months, bronchiectasis, and frequent exacerbations of chronic obstructive pulmonary disease necessitating glucocorticoid therapy or antibiotic use. Strong risk factors for MRSA include known colonization or previous infection and gram-positive cocci in clusters on Gram's staining; weak risk factors include receipt of IV antibiotics in the previous 3 months, recent influenza-like illness, cavitary infiltrate or empyema, and end-stage renal disease. In the presence of any strong risk factors, initiation of empirical therapy targeting MRSA or *Pseudomonas aeruginosa* is recommended. However, in patients with weak risk factors, the decision to initiate empirical therapy for multidrug-resistant pathogens should be based on clinical judgment and individual assessment. For patients in group 1 who are receiving care in the intensive care unit, combination therapy is recommended with a beta-lactam plus macrolide or a beta-lactam plus fluoroquinolone. The selection of an antipseudomonal antibiotic should be made on the basis of the susceptibilities of previous isolates or hospital antibiograms (or both), if available. Empirical therapy with two agents may be needed if the local prevalence of drug-resistant strains is high or in patients with a history of multidrug-resistant infection. The combination of piperacillin–tazobactam and vancomycin has been associated with acute kidney injury; we generally avoid this combination if possible. Recommended therapies and doses for patients with normal renal function are ampicillin–sulbactam (3 g IV every 6 hours), ceftriaxone (1 to 2 g IV daily), cefotaxime (1 to 2 g IV every 8 hours), azithromycin (500 mg IV or orally daily), clarithromycin (500 mg twice daily) or clarithromycin XL (two 500-mg tablets once daily), doxycycline (100 mg orally or IV twice daily), levofloxacin (750 mg IV or orally daily), moxifloxacin (400 mg IV or orally daily), omadacycline (200-mg IV loading dose on day 1 followed by 100 mg IV daily, or 300 mg orally twice daily on day 1 then 300 mg daily), lefamulin (150 mg IV every 12 hours or 600 mg orally every 12 hours), vancomycin (15 to 20 mg per kilogram of body weight IV every 8 to 12 hours or a loading dose of 20 to 35 mg per kilogram IV not to exceed 3000 mg for severe CAP; subsequent dose amounts should be based on area-under-the-curve values), linezolid (600 mg IV or orally twice daily), piperacillin–tazobactam (4.5 g IV every 6 hours), cefepime (2 g IV every 8 hours), ceftazidime (2 g IV every 8 hours), imipenem (500 mg IV every 6 hours), and meropenem (1 g IV every 8 hours).

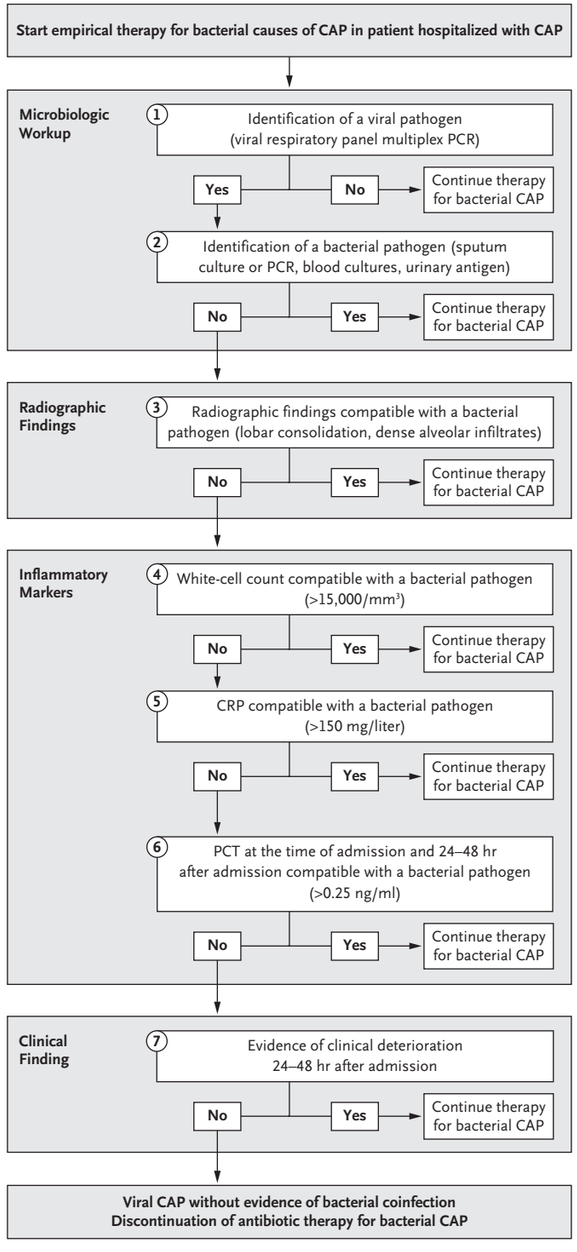

Figure 5. Discontinuation of Antibacterial Therapy in Viral Pneumonia without Evidence of Bacterial Coinfection.

CRP denotes C-reactive protein, PCR polymerase chain reaction, and PCT procalcitonin.

Hospitalized Patients

The choice of the appropriate antibiotic agent for treatment of a patient who has been admitted to the hospital is based on the presence of risk factors for MRSA or pseudomonas (or both), as shown in Figure 4. In patients admitted to a general ward without risk factors for MRSA or pseudomonas, combination therapy with a beta-lactam plus a macrolide or doxycycline or monotherapy with a fluoroquinolone is recommended (see group 1 in Fig. 4). Although data from randomized trials are lacking, many observational studies have suggested that macrolide combination regimens are associated with better clinical outcomes in patients with severe community-acquired pneumonia, possibly owing to the immunomodulatory effects of macrolides.[28-31] If risk factors for MRSA, pseudomonas, or other gram-negative pathogens not covered by the standard community-acquired pneumonia regimens outlined above are present, coverage should be expanded (see groups 2, 3, and 4 in Fig. 4).

Patients with severe community-acquired pneumonia who are admitted to the ICU are more likely to be at risk for resistant pathogens, including MRSA and pseudomonas.[1,32,33] The establishment of an etiologic diagnosis is important in the treatment of these patients. Evidence to guide appropriate therapy in patients with severe community-acquired pneumonia is limited, but common practice is to administer anti-MRSA therapy and antipseudomonas therapy to patients in the ICU who have shock that is being treated with vasopressors or respiratory failure that necessitates mechanical ventilation, pending results of cultures and PCR tests (group 4 in Fig. 4).[34]

Therapies that modify the host response, such as dexamethasone, interleukin-6 inhibitors, and kinase inhibitors, have been established for patients with community-acquired pneumonia due to SARS-CoV-2 infection.[25] The use of glucocorticoids in the treatment of other causes of community-acquired pneumonia is evolving, with recent evidence showing a benefit of survival among patients with severe community-acquired pneumonia (i.e., patients who had been admitted to the ICU and had received mechanical ventilation) and patients at high risk for respiratory failure who had been treated with hydrocortisone at a dose of 200 mg daily initially, followed by a taper.[35] Glucocorticoid therapy should be avoided in patients with influenza or aspergillus pneumonia.

DE-ESCALATION OF ANTIMICROBIAL THERAPY

If the etiologic cause of community-acquired pneumonia has been identified by means of reliable microbiologic methods and there is no laboratory or epidemiologic evidence of coinfection, treatment regimens should be simplified and directed toward that pathogen.[36,37] If a causative pathogen is not identified, empirical treatment should be continued, provided the patient's symptoms are abating. If a screening nasal swab for MRSA is negative, empirical anti-MRSA therapy can usually be discontinued.

In patients in whom viral community-acquired pneumonia is suspected owing to the identification of a virus (including SARS-CoV-2) by means of a molecular test and in whom there is no evidence of concurrent bacterial infection or clinical deterioration, antibacterial treatment can be discontinued (Fig. 5). Most patients have some clinical improvement within 48 to 72 hours after the start of antibacterial treatment. Intravenous antibiotic regimens can be transitioned to oral regimens with a similar spectrum activity as the patient's condition improves.[38,39]

DURATION OF THERAPY

Typically, patients continue to receive treatment until they have been afebrile and in a clinically stable condition for at least 48 hours. Treatment should usually continue for a minimum of 5 days; however, 3 days may be an adequate treatment duration for certain patients whose condition is completely stable.[40-42] Extended courses of therapy may be indicated for patients with immunocompromising conditions, infections caused by certain pathogens (e.g., *P. aeruginosa*), or complications such as empyema. Serial procalcitonin thresholds as an adjunct to clinical judgment may help guide the discontinuation of antibiotic therapy.[17,18]

HOSPITAL DISCHARGE AND FOLLOW-UP

Hospital discharge is appropriate when the patient is in a clinically stable condition, is able to take oral medication, and has a safe environment for continued care; overnight observation after a switch to oral therapy is not necessary. Early discharge based on clinical stability and criteria for the switch to oral therapy is encouraged to reduce unnecessary hospital costs and risks associated with hospitalization.

Communication and coordination with the patient's primary care clinician for early outpatient follow-up is encouraged to reduce the likelihood of readmission to the hospital.[43] A follow-up chest radiograph is indicated in only a minority of patients, such as those at risk for lung cancer on the basis of age, smoking history, or persistence of symptoms.[1,44]

PREVENTION

Smoking and excessive alcohol consumption should be addressed. In addition, vaccines against influenza, Covid-19, and *Strep. pneumoniae* should be administered according to current Advisory Committee on Immunization Practices recommendations.[45]

GUIDELINES

The recommendations we describe align with the most recent ATS–IDSA guidelines.[1] We agree with the recommendation that the addition of anaerobic coverage for suspected aspiration pneumonia should not be routine practice unless there is evidence of a lung abscess or empyema. The current guidelines were published before the Covid-19 pandemic and suggest selective microbiologic testing. However, we now advocate for a more comprehensive approach to microbiologic testing for all hospitalized patients with community-acquired pneumonia, including testing for SARS-CoV-2 infection.

AREAS OF UNCERTAINTY

The role of the lung microbiome in community-acquired pneumonia is an area of ongoing research.[8] Further understanding of the lung microbiome may provide information regarding inflammatory response and susceptibility to specific pathogens.

Microbiologic diagnosis with the use of rapid multiplexed molecular platforms is a swiftly advancing technology.[22] Further studies are needed to determine the clinical effect and cost–benefit ratio of these rapid molecular tests.

Although ATS–IDSA guidelines recommend monotherapy with amoxicillin as a first-line option for ambulatory patients at low risk, we often add a macrolide that targets atypical pathogens, since such pathogens are relatively common and not readily identified in low-risk patients, and treating such patients may hasten recovery.[46-48]

There is an observed association between community-acquired pneumonia and an increased risk of cardiovascular disease.[49,50] Further studies are needed to gain a better understanding of this relationship and to develop interventions aimed at reducing cardiovascular risk as well as the risk of other sequelae of community-acquired pneumonia.

CONCLUSIONS AND RECOMMENDATIONS

The patient described in the vignette was clinically stable, had a CURB-65 score of 2, and had only one minor criterion for severe community-acquired pneumonia (i.e., confusion); therefore, he should be admitted to a general ward. Although a viral pathogen was identified, we would be concerned about secondary bacterial infection, particularly given the elevated procalcitonin level. In the absence of known risk factors for MRSA or pseudomonas, we would initiate treatment in the emergency department with intravenous azithromycin and ceftriaxone. If testing proved negative for atypical bacteria, we would discontinue azithromycin therapy. We would discharge him with continued oral therapy (e.g., amoxicillin–clavulanate if no bacterial pathogen was identified); if his condition had reached clinical stability in 48 to 72 hours, he should complete a 5-day course of the medication. Outpatient follow-up should be scheduled a week after discharge.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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At BHS, we also understand the importance of balancing work with quality of life. The Berkshires, a 4-season resort community, offers world renowned music, art, theater, and museums, as well as year round recreational activities from skiing to kayaking. Excellent public and private schools make this an ideal family location. We are also only a 2½ hours drive from both Boston and New York City.

Contact us to learn more about these exciting opportunities to practice in a beautiful and culturally rich region, as part of a sophisticated, award-winning, patient-centered healthcare team.

Interested candidates are invited to contact:

Michelle Maston or Cody Emond
Provider Recruitment, Berkshire Health Systems
(413) 447-2784 | mmaston@bhs1.org
cemond@bhs1.org
Apply online at: berkshirehealthsystems.org

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San Juan Regional Medical Center

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- Family Medicine OP
- Gastroenterology
- ENT
- General Surgery
- Internal Medicine OP
- Neurology
- Physiatry
- Psychiatry
- Intensivist
- OB/GYN
- General Pulmonology
- Nephrology/IM
- Hospice/Palliative Care

Advanced Practice Opportunities

- CRNA
- General Surgery PA
- CAA
- Interventional Spine PA
- Cardiology NP/PA
- Gastroenterology NP/PA
- Family Medicine NP
- Urology PA
- Diabetes Management/ Spine NP

San Juan Regional Medical Center is a non-profit and community governed facility. Farmington offers a temperate four-season climate near the Rocky Mountains with world-class snow skiing, fly fishing, golf, hiking, and water sports. Easy access to world renowned Santa Fe Opera, cultural sites, National Parks, and monuments. Farmington's strong sense of community and vibrant Southwest culture make it a great place to live.

Contact Terri Smith at 888.282.6591 or 505.609.6011
tsmith@sjrmc.net | sanjuanregional.com | sjrmcdocs.com

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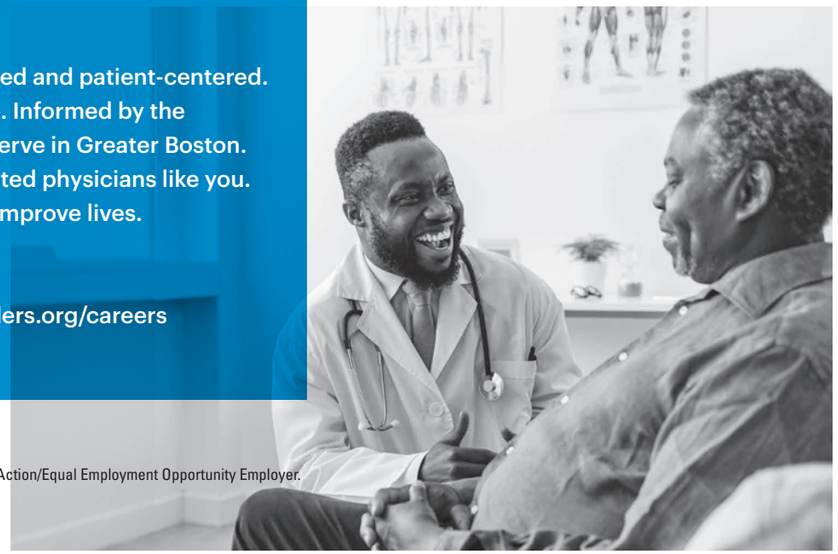

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School of Medicine

Department of Medicine
Division of Hospital Medicine

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You can also email: Mark V. Williams, MD, MHM
Professor & Chief, Division of Hospital Medicine
hospitalist@wustl.edu

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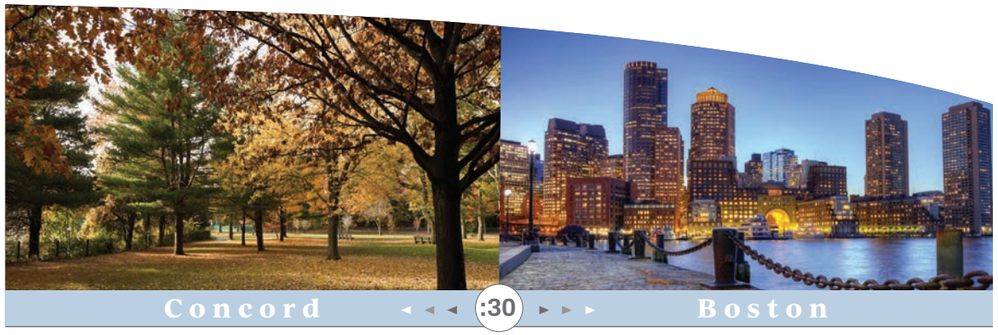

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fax: 978-287-3600

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Our core mission is to deliver exceptional, patient-centered care that is highly reliable, safe, compassionate, equitable, efficient and coordinated. While we provide most of the services that patients will ever need, the hospital's strong clinical collaborations with Boston's academic medical centers ensures our patients have access to world-class resources for more advanced care.

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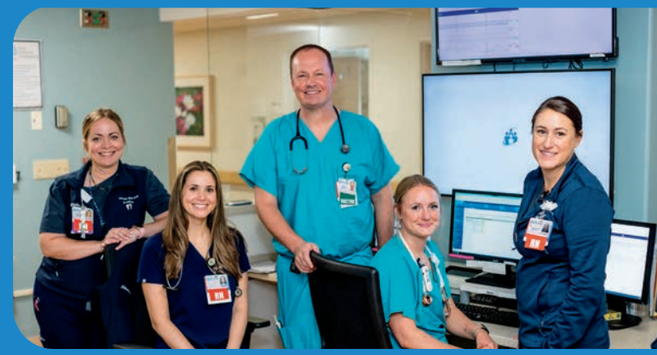

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GLOBAL SPOTLIGHT:
The Medical AI Forum Elevates Suzhou's Entrepreneurship Week, aiming to Boost Biopharma and Attract Global Healthcare Talent

On July 11, 2023, the Medical AI Forum took center stage at the 15th Suzhou International Elite Entrepreneurship Week and Suzhou Scientist Day. The forum attracted distinguished scholars and industry leaders from around the world to gather in Suzhou to discuss the cutting-edge applications and potential impacts of artificial intelligence in the medical field.

With a global emphasis, the forum convened numerous industry insiders. The speakers and panelists were from College of Future Technology Peking University, University of California, San Francisco, Macau University of Science and Technology School of Medicine, SINTEF Digital Health, Insilico Medicine, and Global Health Education Foundation. Experts delved deep into medical AI's direction, sharing their insightful views on development and research topics.

In his keynote speech, Dr. Louis Ptacek emphasized the potential of using AI to analyze vast amounts of genetic data related to sleep disorders. This approach promises to significantly advance our understanding of sleep research, offering new insights and implications. Professor Kang Zhang and Dr. Alex Zhavoronkov analyzed new directions in AI's application in medical care and drug research. Dr. Charlotte Haug emphasized that for AI tools to gain acceptance, clinical trials must demonstrate their benefits for patients, health professionals, and the broader healthcare system.

Upholding the philosophy of cross-disciplinary and cross-industry integration, the forum sought to play a crucial role in advancing a shared vision for humanity, by spearheading the transformation of global medical services and by leveraging AI to enhance healthcare quality for all.

The forum showcased Suzhou's biopharmaceutical achievements and dedication, while also aiming to attract global healthcare and pharmaceutical talent to enhance human well-being.

For more information about career opportunities in Suzhou, please contact info@ivy-tech.org.

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