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Eric J. Rubin, MD, PhD

Supporting Physician Wellness: Health Care Organizations Seeking — and Piloting — Programs to Help Physicians Manage Their Work-Life Stressors

By Bonnie Darves

Just when organizations were formally recognizing that many of their physicians were seriously struggling with burnout and had started to seek remedies to address the endemic problem, the pandemic hit. The timing could not have been worse, many experts on physician burnout agree, and yet, for the most part, the physician workforce navigated the added stressors of COVID-19 both admirably and competently. Physicians worked in highly functioning teams to save lives, mitigate the virus’ impact on patients, and offer the highest standard of care possible under the circumstances. Many physicians also helped their organizations chart a “survival path” to navigate the operational crises the pandemic unleashed.

Organizations that employ physicians, having witnessed the steep toll that the pandemic on top of burnout took, are understandably concerned about the state of their workforce. Many organizations are actively seeking, developing, and trying out wellbeing improvement programs to help bolster physicians and other clinicians. Health care leaders are recognizing, too, that physicians are hardly exempt from “the great resignation” our country is experiencing among workers.

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Numerous approaches are being piloted or implemented, with varying degrees of success. These range from informal offerings such as hospital “wellness wagons” delivering a combination of snacks and cheering-up support and wellbeing days off for residents and fellows, to more structured programs. Examples of formal offerings include buddy systems mimicking military-type “battle buddy” practices, mental-health check-in offerings, and physician coaching resources.

The latter, when provided with anonymity guaranteed, appear to be somewhat effective for those who access them, according to Eileen Barrett, MD, MPH, a hospitalist and educator who formerly directed graduate wellness initiatives at the University of New Mexico (UNM). “Many physicians who have received coaching have benefited, and some organizations have been able to demonstrate real outcomes,” said Dr. Barrett, who now practices with the Indian Health Service and has published on advocated for national clinician wellbeing improvement strategies. She said that UNM’s mental health check-ins, a “renewable” offering, were also relatively well received — 78 of the 109 physicians who booked appointments when the program launched kept those appointments.

Some organizations, such as Intermountain Healthcare in Salt Lake City, Utah, are trying several approaches simultaneously — developing a physician and advanced practice provider (APP) wellbeing center and dedicated portal and scheduling wellness-focused grand rounds and separate leadership rounds to celebrate successes and learn what clinicians are struggling with in their work. Intermountain also provides a range of peer-support forums and options for connecting caregivers, aimed at offering a confidential forum for sharing emotions.

“My task is to develop resources and learn from others around the country — and at Intermountain, we’re all working on this together to determine what works and what’s not helpful,” said Anne Pendo, MD, an internist who is senior medical director of Provider Experience and Wellbeing at Intermountain. “What we all recognize, I think, is that we as a profession weren’t well before the pandemic,” she said, and that the pandemic further eroded physician resiliency. “Now we have an opportunity to try to discover ways to improve wellbeing and then implement them.”

Peer-support programs taking hold

At Intermountain, of the initiatives piloted to date, the peer-support offerings have trained nearly 100 physicians to serve in the role and approximately 300 physicians and clinicians have participated. “I think it’s important to position this as ‘I can be a helper’ if you want physicians to get involved, and to ensure you offer a safe space for sharing feelings — something physicians have historically struggled with,” she said, because of fear they’ll be perceived as weak.

Researchers and physicians involved in developing wellness-support programs and resources are finding that although it’s challenging to figure out exactly what physicians do need in support, there’s growing consensus on what physicians don’t want: Tips and recommendations for improving their personal resilience. In other words, Dr. Barrett said, “Physicians don’t want to hear about another yoga class or meditation practice.”

Heather Farley, MD, chief wellness officer at ChristianaCare in Delaware, which rolled out the “wellbeing wagon” described earlier and created a Center for Worklife Wellbeing, concurred with Dr. Barrett. “What doesn’t work is focusing too much on the personal minutiae, such as sleep hygiene. Whatever you offer has to support physicians “in their work environment;” said Dr. Farley, an emergency medicine physician. Like Intermountain, ChristianaCare has seen a gradual but steady utilization uptake of peer-support offerings. “We’re shifting away from the culture of ‘shame and blame’ to one that says, ‘It’s OK not to be OK,’ and to reach out if you need help,” she said.

At the University of Minnesota, which created the buddy system a few months into the pandemic and rolled out the program in a matter of weeks, the model was predicated on the recognition that Dr. Farley cites: everyone needs help sometimes and it’s important to know that someone has your back and is willing to help. In the university’s program, modeled in part on both the military-battlefield scenario and observations an anesthesiologist made in the operating room during the early weeks of the pandemic, when staff members were becoming more nervous, buddies are “paired” somewhat strategically. Ideally, they’re close in age and career length and experience, so that they can both recognize and understand the stressors their buddy is experiencing — and identify when that buddy needs some extra support.

“We decided that the battle-buddy system was a brilliant idea and decided to give it a decent trial,” said Cristina Sophia Albott, MD, who heads the university’s division of adult mental health. “We wrote the protocol in one week, started the program in two weeks, and rolled it out across the
enough supported, are taking note. They're actively trying to figure out what physicians want and need to care for patients with fewer frustrations.

Physician professional organizations are also stepping in to identify what's needed now in institutional supports to help physicians mitigate burnout and regain resiliency. The American College of Physicians' Patients Before Paperwork initiative, for example, has identified the most burdensome tasks and regulatory requirements that internists face and offered policy recommendations for reducing associated workload. The American Medical Association has also developed a multifaceted initiative to provide guidance and targeted solutions to health care organizations for many of the problems that threaten physician wellbeing.

In an article published in the Annals of Internal Medicine in September 2021, Dr. Barrett and her co-authors proposed a series of steps that organizations might take to reduce clinician burnout, keep physicians in the workforce as the health system continues to navigate COVID-19, and simply make physicians' practice lives more tolerable. In addition to the COVID-related recommendations for improving physician safety and providing practical support as needed to address system-capacity constraints, the authors urged organizations to do the following:1

• Help ensure more flexible scheduling for physicians who are parents or care for aging parents.

• Reduce, eradicate, or reassign administrative tasks and meetings that aren't mission critical and haven't delivered improved patient outcomes.

• Provide no-cost and truly confidential mental-health support services — and also truly encourage physicians to use their available vacation and professional development time to nurture a healthier workplace. At the same time, organizations should update credentialing and employment applications to remove unnecessary questions related to mental and physical health diagnoses, to reduce the associated stigma.

Dr. Barrett offers another recommendation to employer organizations. "If you offer resources that might support or improve physician wellbeing, make sure your physicians know about them. Physicians are so stretched and busy that they might not know what's available," she said.

desperately seeking on-the-ground support and remedies

What physicians do want in the way of support from their organizations, Dr. Barrett and others interviewed for this article agree, is operational load-lightening, however that can be achieved and institutionalized. Offerings such as onsite childcare and schedule flexibility to address family needs rank high on the wish list for many physicians, and there's a growing consensus that the electronic health record (EHR) persists as a chief source of physician frustration and stress, despite years of organizations' attempts to ameliorate the problem.

“What does appear to work is providing physicians protected time for EHR training or having dedicated information technology (IT) support for dealing with EHR-related issues,” Dr. Barrett said, or adding scribes to offload the bulk of EHR-data entry processes. In similar fashion, physicians would appreciate their institutions removing the burden of treatment prior-authorization management. And she noted that the incredibly complex and inordinately inefficient processes related to physician credentialing are ripe for fixing, as they're unnecessarily burdensome for physicians. “If credentialing were centralized, at least for Medicare, that would go a long way in reducing the burden. Most people think that the system, as it stands, doesn't really make anyone safer,” Dr. Barrett said.

Health care organizations, concerned about both their physicians' wellbeing and their facilities' ability to maintain adequate staffing levels in a time when many physicians are deciding to leave jobs where they don't feel well...
**Tips for structuring physician-wellness support offerings**

All sources who participated in this article offered guidance for organizations trying to provide resources that might help improve physician well-being. Here are a few:

- Understand that each environment is different, which means that the problems and needs might vary widely from one health care organization to another. To develop appropriate solutions and resources, ensure that physicians are directly involved in creating them.

- Avoid focusing resources on individual-physician resilience and instead focus on system approaches that might have the added benefit of helping physicians support one another and reduce unnecessary workload. Keep in mind that some physicians have an innate distrust of “corporate-sponsored” initiatives that appear to be focused on the bottom line.

- Provide a safe forum for physicians to recommend institutional approaches that mitigate the burdens that contribute to burnout and also make their overall work lives more realistically manageable.

- If you try a wellness initiative and it doesn’t produce results that are valuable to physicians, be ready and willing to abandon it. Then be prepared pilot something else — quickly.


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**Knowing Your Worth in the Physician Job Market**

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

One thing physicians seldom do in the training setting is talk about money. Between daily clinical responsibilities and call, a never-ending amount of information to learn, and doing your best to keep up with the other aspects of your life, most of us would agree we’re in survival mode for most of our residency and fellowship. Learning the business and financial aspects of a life in medicine doesn’t usually make it to the priority list.

Consequently, as the end of training approaches, most physicians find themselves overwhelmed with the prospect of finding a job, and underprepared for negotiations. Many just feel grateful to have come to the conclusion of a long journey. After years of being paid a very low hourly rate and (on average) holding substantial six-figure debt, it’s tempting to just be happy with the positive cash flow.

Not doing the requisite research before talking about numbers will almost always work against you. I routinely find myself encouraging physicians to know their worth — not just because I think physicians have the expertise to warrant earnings that reflect it, but because career longevity and job satisfaction are closely intertwined with feeling valued. When I counsel
you should ask for more, give feedback on things like partnership and bonus structures, and protect you from expensive mistakes. After all that you've spent to get to this point, it's a worthwhile investment to make sure your contract is fair and in your best interest.

In every negotiation, both sides will understandably try their hardest to get the best deal for themselves. This is a business transaction, and should be approached as such. There will be give and take on both sides, but having a solid understanding of your worth will empower you to advocate for it.

And remember...if you don’t ask, you won’t get.

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early-career physicians who are dissatisfied, this is often the reason they end up seeking other opportunities within the first five years of practice.

As salary transparency is not commonplace in medicine, trainees (and their older counterparts as well, for that matter) often don’t know how to evaluate offers or know what reasonable expectations are. This is a significant disadvantage at the negotiating table, and why physicians must put the research into figuring out their market value.

Many mistakenly assume that knowing your worth means simply looking at widely cited compensation databases such as Medical Group Management Association (MGMA) and Association of American Medical Colleges (AAMC). These are available for purchase or may be available from your hospital libraries or your contract attorney. Although a great place to start, it’s important to take this data into context. Compare not only the salary numbers, but the actual compensation per RVU. Know that this can range widely even within the same region of the United States depending on exact location, type of practice, stage of practice, how competitive the job market is, and a host of other factors. You should dig deeper. If the job is at an institution where compensation data is published, such as state and government organizations, look up the salaries of other physicians there. Ask your medical school classmates, mentors, training program alumni, and other physicians in your network who may have knowledge of or connections within the pertinent market.

Importantly, realize there is a lot of work that you do that may not be reflected in RVUs. This may take the form of call responsibilities, teaching or research expectations, or administrative duties. These are all things that contribute to your worth to an employer, and should be factored in when calculating your market value.

Next, it’s important to do your research on the employer. Do you have a particular skill they are in need of? Some skills that may strengthen your bargaining position include fluency in a foreign language, procedural skills, the potential to attract certain patient populations, or the ability to develop a niche that the practice does not currently offer.

Finally, utilize a contract attorney, ideally one that is experienced with physician contracts. Many trainees are hesitant to spend the money, but having the objective feedback on how your deal compares to others is well worth it. Oftentimes, they will be able to point out areas where
A 41-year-old man presents to the emergency department with a 3-week history of breathlessness. He recently completed a course of antibiotic medication for presumed pneumonia. On the day of presentation, he awoke with dull pain on the right side of the back. His medical history is otherwise unremarkable. His heart rate is 88 beats per minute, blood pressure 149/86 mm Hg, respiratory rate 18 breaths per minute, temperature 37°C, and oxygen saturation 95% while he is breathing ambient air. Auscultation of his chest reveals normal breath sounds and normal heart sounds. An examination of the legs is normal. His creatinine and troponin levels are within normal limits, and a radiograph of the chest is normal. The physician’s implicit assessment is that the likelihood of pulmonary embolism is greater than 15%. The patient’s Wells score is 0 (on a scale of 0 to 12.5, with higher scores indicating a higher probability of pulmonary embolism), and the d-dimer level is 2560 ng per milliliter. How would you evaluate this patient for pulmonary embolism, and how would you manage this case?
PULMONARY EMBOLISM
- Pulmonary embolism is a common diagnosis and can be associated with recurrent venous thromboembolism, bleeding due to anticoagulant therapy, chronic thromboembolic pulmonary hypertension, and long-term psychological distress.
- A minority of patients who are evaluated for possible pulmonary embolism benefit from chest imaging (e.g., computed tomography).
- Initial treatment is guided by classification of the pulmonary embolism as high-risk, intermediate-risk, or low-risk. Most patients have low-risk pulmonary embolism, and their care can be managed at home with a direct oral anticoagulant.
- Patients with acute pulmonary embolism should receive anticoagulant therapy for at least 3 months.
- The decision to continue treatment indefinitely depends on whether the associated reduction in the risk of recurrent venous thromboembolism outweighs the increased risk of bleeding and should take into account patient preferences.
- Patients should be followed longitudinally after an acute pulmonary embolism to assess for dyspnea or functional limitation, which may indicate the development of post-pulmonary-embolism syndrome or chronic thromboembolic pulmonary hypertension.

STRATEGIES AND EVIDENCE

DIAGNOSTIC TESTING FOR PULMONARY EMBOLISM
Perhaps the most challenging aspect of testing for pulmonary embolism is knowing when to test. Common symptoms of pulmonary embolism are fatigue, breathlessness, chest pain, dizziness, cough, diaphoresis, fever, and hemoptysis. A meta-analysis of cohort studies showed that a history of dyspnea, immobilization, recent surgery, active cancer, hemoptysis, previous venous thromboembolism, or syncope was associated with an increased likelihood of pulmonary embolism. Testing for pulmonary embolism should also be considered if a patient appears not to have had a response to treatment for another diagnosed respiratory condition, because initial misdiagnosis is common.

In North America, pulmonary embolism is a diagnosis that physicians should be aware of for every patient who has tested for the presence of pulmonary embolism when they present to the emergency department. This prevalence has remained stable for two decades and is four times lower than the prevalence reported among patients in Europe. These guidelines do not stipulate which patients should undergo testing for the presence of pulmonary embolism. Qualitative research suggests that physicians' perceptions and local culture are major drivers in the decision to test for pulmonary embolism.

Noninvasive tests to rule out the diagnosis that are based on the assessed clinical probability of pulmonary embolism are extremely effective in safely reducing the use of computed tomography (CT), resulting in only 30 to 40% of patients with suspected pulmonary embolism subsequently undergoing diagnostic imaging.

In cases in which physicians have an implicit sense that their patient is very unlikely to have pulmonary embolism (estimated likelihood, ≤15%), large cohort studies have shown that the Pulmonary Embolism Rule-out Criteria (PERC) rule can safely rule out pulmonary embolism without further diagnostic imaging. In practice, however, implicit estimation typically overestimates the probability of pulmonary embolism, which can limit the use of the PERC rule. Physicians should be familiar with a validated decision rule to guide the use of d-dimer testing. Among patients with a low probability score — a Wells score of 4.0 or less (found in 80% of patients tested in North America), a revised Geneva score of 10 or less (on a scale ranging from 0 to 22, with higher scores indicating a greater probability of pulmonary embolism), and a simplified Geneva score of 4 or less (on a scale ranging from 0 to 9, with higher scores indicating greater probability of pulmonary embolism) — pulmonary embolism can be safely ruled out on the basis of d-dimer levels when manufacturer-recommended cutoffs were used (sensitivity, 98 to 99%; specificity, 37% to 40%). Additional details of the scoring systems and their use are provided in Figure 1. Older data from a different d-dimer assay suggested that a d-dimer level of less than 500 ng per milliliter could be used to rule out pulmonary embolism without consideration of clinical risk factors, but more data are needed to confirm the usefulness of this approach with current assays and relative to currently recommended strategies. The diagnostic accuracy of d-dimer testing in patients with coronavirus disease 2019 (COVID-19) remains unchanged.

Newer approaches have adjusted the d-dimer threshold for ruling out pulmonary embolism and are validated for d-dimer assays for which the manufacturer-recommended cutoff is equivalent to 500 ng per milliliter. These strategies include d-dimer levels that are adjusted for age (reported sensitivity for the age-adjusted approach ranges from 97 to 99%, and specificity ranges from 42 to 47%)) or that are adjusted to the YEARS algorithm for ruling out pulmonary embolism (sensitivity, 96 to 98%; specificity, 54 to 63%)) or the Wells score (sensitivity, 91 to 97%; specificity, 61 to 67%). Randomized trials that compare various d-dimer strategies in patients with pulmonary embolism are lacking.

Diagnostic imaging is reserved for patients in whom pulmonary embolism cannot be ruled out on the basis of a decision rule, given the potential harms of radiation exposure. CT pulmonary angiography is usually the most timely and accessible imaging technique; however, to minimize lung and breast-tissue irradiation in younger patients, ventilation-perfusion single-photon-emission CT (SPECT) is a low-radiation option. The incidence of false positive results from CT screening vary among providers and may be as high as 5%. Within 3 months after having normal results on CT that had been performed because of suspicion of pulmonary embolism, 1.2% of patients receive a diagnosis of venous thrombosis. In contrast, the diagnostic performance of venous thrombosis SPECT has not been well established.

Many patients who have been hospitalized for an unrelated condition are also tested for pulmonary embolism; there is less evidence to guide d-dimer use in these patients. Although d-dimer levels may still be highly sensitive for testing patients who are hospitalized, they are less useful in ruling out pulmonary embolism because levels are often elevated during illness and after surgery.

TREATMENT
Initial Management
Initial treatment of pulmonary embolism is guided by risk stratification of the pulmonary embolism as high, intermediate, or low risk on the basis of the patient’s clinical presentation (Fig. 2). The nomenclature of “massive” and “submassive” in describing pulmonary embolism is confusing, given that clot size does not dictate therapy.

High Risk
Approximately 5% of patients present with high-risk pulmonary embolism, involving shock, organ hypoperfusion, hypotension (systolic blood pressure <90 mm Hg or a decrease in systolic blood pressure of >40 mm Hg that is not caused for the sepsis, arrhythmia, or hypovolemia), or cardiac arrest. Observational data support the evaluation of patients with high-risk pulmonary embolism for immediate reperfusion therapy by ruling out contraindications (e.g., brain metastases, bleeding disorders, and recent surgery). Intravenous systemic thrombolysis is the most readily available option for reperfusion, and protocols include a weight-based dose of tenecteplase, alteplase at a dose of 0.6 mg per kilogram of body weight, or alteplase at a dose of 100 mg administered over a period of 1 to 2 hours. There is insufficient evidence to support one of these agents over the other. Tenecteplase and alteplase can be administered over 15 minutes as a bolus in an emergency, and weight-based dosing may be preferable in elderly patients or patients with low body weight. Alternative reperfusion approaches include surgical thrombectomy and catheter-directed thrombolysis (with or without thrombectomy). Additional supportive measures include the administration of inotropes and the use of extracorporeal life support.

Intermediate Risk
Patients with echocardiographic or CT evidence of right heart strain, elevated cardiac biomarkers (such as troponin or brain natriuretic peptide), or both are considered to have intermediate-risk pulmonary embolism. Systemic thrombolysis is not typically recommended for these patients; in this setting, intravenous heparin or low molecular weight heparin (LMWH) may be more appropriate. Care should be taken not to confuse these patients with intermediate-risk pulmonary embolism. Patients in whom mechanical thrombectomy or catheter-directed thrombolysis (with or without thrombectomy) may be more appropriate. Care should be taken not to confuse these patients with intermediate-risk pulmonary embolism.
Patients with pulmonary embolism whose conditions are hemodynamically stable and who have no right ventricular strain or normal cardiac biomarkers are considered to have low-risk pulmonal embolism. Most of these patients can be treated with a direct oral anticoagulant (on the basis of high-quality trial data) and assessed for outpatient treatment. The decision for a patient to be treated at home can be guided by the score on the simplified Pulmonary Embolism Severity Index (PESI) or the Hestia score (Fig. 2). In contrast to the Geneva score (a checklist of criteria that preclude treatment at home), the score on the simplified PESI predicts the risk of death rather than nonfatal complications and does not account for important variables such as the availability of support for the patient at home.

Results of a randomized, controlled trial showed a low risk of adverse events among patients with no Hestia criteria or with a score of 0 on the simplified PESI who received treatment as outpatients.21,22

Subsequent Management

Direct oral anticoagulants are the first-line treatment for most patients. Randomized trials have shown that direct oral anticoagulants, which do not necessitate monitoring, are as effective at reducing the risk of recurrent venous thromboembolism as vitamin K antagonists and result in a lower risk of major bleeding.24 Because comparisons of direct oral anticoagulants are lacking, the choice of agent is guided by pharmacologic properties and patient characteristics and preferences (e.g., concomitant interacting medications and patient preference for once-daily or twice-daily medication).25 In patients with cancer, trials support the safety and efficacy of the direct oral anticoagulants apixaban, edoxaban, and rivaroxaban as alternatives to treatment with low-molecular-weight heparin.26

Vitamin K antagonists are preferred over direct oral anticoagulants in patients with advanced kidney or liver disease and in patients with antiphospholipid syndrome who are triple-positive (i.e., positive for lupus anticoagulant, anticardiolipin, and anti-β2-glycoprotein I antibodies), have very high antibody titers, or have a history of arterial thrombosis.27,28 Low-molecular-weight heparin should be used to treat pregnant women.
Pulmonary embolism (PE) has been diagnosed

High-Risk PE
- Shock, end-organ hypoperfusion, hypotension, or cardiac arrest

Intermediate-Risk PE
- Signs of right heart strain on imaging, elevated troponin or BNP, or both

Low-Risk PE
- All other patients

Immediate reperfusion therapy

Admit, monitor vital signs, and administer LMWH

Choose and know one decision tool for determining disposition:

- No Hestia criteria
- OR
- Simplified PESI score = 0
- OR
- Implicit assessment that patient’s condition is stable without IV medication or oxygen and that the patient has sufficient home support and is not at risk for imminent bleeding

Patient suitable for discharge:
- Discharge from hospital while taking DOAC (LMWH or VKA if indicated)

Patient not suitable for discharge:
- Admit, DOAC (LMWH or VKA if indicated)

Table 1. Anticoagulant Treatment Regimens for Pulmonary Embolism.4

<table>
<thead>
<tr>
<th>Initial Phase of Anticoagulation</th>
<th>Short-Term Phase of Anticoagulation (3–6 mo)</th>
<th>Indefinite Phase of Anticoagulation (after 3–6 mo)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apixaban, administered orally, 10 mg twice a day for 7 days</td>
<td>Apixaban, administered orally, 5 mg twice a day</td>
<td>Apixaban, administered orally, 5 mg twice a day or 2.5 mg twice a day†</td>
</tr>
<tr>
<td>Rivaroxaban, administered orally, 15 mg twice a day for 21 days</td>
<td>Rivaroxaban, administered orally, 20 mg once a day</td>
<td>Rivaroxaban, administered orally, 20 mg once a day or 10 mg once a day¶</td>
</tr>
</tbody>
</table>

Low-molecular-weight heparin:‡

- Administered subcutaneously for a minimum of 5 days§
- Administered subcutaneously for a minimum of 5 days
- Administered subcutaneously for a minimum of 5 days, plus vitamin K antagonist, administered orally, with INR ≥2 for 2 days

- Dabigatran, administered orally, 150 mg twice a day
- Edoxaban, administered orally, 60 mg once a day
- Vitamin K antagonist, administered orally, with target INR of 2 to 3

- Dabigatran, administered orally, 150 mg twice a day
- Edoxaban, administered orally, 60 mg once a day
- Vitamin K antagonist, administered orally, with target INR of 2 to 3

Key

- Hestia score
  - Condition is hemodynamically unstable
  - Patient considered for reperfusion strategy
  - High risk of bleeding
  - Oxygen supplementation indicated
  - IV antegna indicated
  - PE was diagnosed while patient was taking an anticoagulant
  - Other medical reason for admission
  - Inadequate social support to discharge
  - Creatinine clearance <30 ml/min
  - Severe hepatic impairment
  - Pregnancy
  - History of heparin-induced thrombocytopenia

- Simplified PESI score

- Points
  - History of cancer
  - History of chronic cardiopulmonary disease
  - Heart rate >110 beats/minute
  - Systolic blood pressure <100 mm Hg
  - Oxygen saturation <90%

- Decision tool

- Rapid, expert outpatient follow-up is available

* Direct oral anticoagulants and low-molecular-weight heparin are contraindicated in patients with severe renal impairment. Dosing of these medications in patients with renal impairment differs with the specific agent and among jurisdictions. With regard to use of direct oral anticoagulants in patients with obesity, post hoc analyses of phase 3 trials, observational data, and pharmacokinetic and pharmacodynamic data suggest that direct oral anticoagulants and vitamin K antagonists have similar effectiveness and safety in patients with body-weight up to 120 kg or a body-mass index (BMI; the weight in kilograms divided by the square of the height in meters) of up to 40. For patients who weigh more than 120 kg or have a BMI higher than 40, standard doses of rivaroxaban or apixaban are among appropriate anticoagulant options. Fewer supportive data exist for apixaban than for rivaroxaban. Other options include vitamin K antagonists, weight-based low-molecular-weight heparin (administered according to manufacturer recommendations), and fondaparinux. 17 INR denotes international normalized ratio.

† A reduction in dose may be considered after 3 to 6 months of therapy.

‡ Low-molecular-weight heparin may be administered subcutaneously throughout initial, short-term, and indefinite phases of treatment, with dosage according to body weight.

¶ Low-molecular-weight heparin should be administered for 3 to 10 days before the initiation of dabigatran or edoxaban and concurrent to initiating vitamin K antagonists.

§ Edoxaban should be administered at a dose of 30 mg daily if the creatinine clearance is 15 to 50 ml per minute, if the patient’s body weight is less than 60 kg, or if potent P-glycoprotein inhibitors are being used.

with pulmonary embolism, since vitamin K antagonists and direct oral anticoagulants cross the placenta and are associated with adverse pregnancy outcomes.25,37 The long-term risk of venous thromboembolism recurrence is low and anticoagulation therapy can be stopped after 3 months. If the pulmonary embolism was very large or was associated with moderate dysfunction of the right ventricle or if the patient has persistent residual symptoms, some experts recommend that treatment extend to 6 months.39 In patients with persistent provoking factors such as active cancer or antiphospholipid syndrome or who have had previous episodes of unprovoked venous thromboembolism...
Recommend against inferior vena cava filter in patients who can receive anticoagulation.

Indications for anticoagulation:

- In patients with cancer, consider same management as in patients with symptomatic PE.
- In high-risk PE, recommend rapid initiation of unfractionated heparin administered intravenously and systemic thrombolysis.
- In presence of contraindications to or failed systemic thrombolysis, recommend surgical pulmonary embolectomy and consider percutaneous catheter-directed treatment.
- In intermediate-risk or low-risk PE, routine use of primary systemic thrombolysis is not recommended.

Table 2. Summary of Key Guideline Recommendations for the Treatment of Pulmonary Embolism.*

<table>
<thead>
<tr>
<th>Scenario</th>
<th>American College of Chest Physicians</th>
<th>American Society of Hematology</th>
<th>European Society of Cardiology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home vs. hospital treatment for low-risk PE</td>
<td>Recommend outpatient treatment if access to medications, care, and home circumstances adequate</td>
<td>Suggest home treatment</td>
<td>Consider early discharge and home treatment if proper outpatient care and anticoagulation can be provided</td>
</tr>
<tr>
<td>Subsegmental PE</td>
<td>In low-risk PE, suggest clinical surveillance and ultrasonography of both legs. In high-risk PE (patients hospitalized, immobile, has cancer, is pregnant, or has unprovoked PE), suggest anticoagulation.</td>
<td>In patients with cancer, suggest short-term anticoagulation instead of observation.</td>
<td>Not addressed</td>
</tr>
<tr>
<td>Choice of anticoagulant</td>
<td>Recommend direct oral anticoagulant instead of vitamin K antagonist. In antiphospholipid syndrome, recommend vitamin K antagonist instead of direct oral anticoagulant.</td>
<td>Suggest direct oral anticoagulant instead of vitamin K antagonist unless severe renal insufficiency, pregnancy or lactation, or antiphospholipid syndrome is present.</td>
<td>Recommend direct oral anticoagulant instead of vitamin K antagonist unless severe renal insufficiency, pregnancy or lactation, or antiphospholipid syndrome is present.</td>
</tr>
<tr>
<td>Treatment of incidentally found asymptomatic PE</td>
<td>Suggest same initial and long-term anticoagulation as in patients with similar symptomatic PE.</td>
<td>Short-term anticoagulation rather than observation suggested in patients with cancer.</td>
<td>In patients with cancer, consider same management as in patients with symptomatic PE.</td>
</tr>
<tr>
<td>Thrombolysis of PE</td>
<td>If thrombomodulin is present, recommend thrombomodulin is followed by anticoagulation of anticoagulation alone. If no thrombomodulin is present but evidence exists of right ventricular dysfunction (according to echocardiogram and biomarkers), recommend anticoagulation alone of routine use of thrombolysis plus anticoagulation.</td>
<td>If thrombomodulin is used, suggest systemic thrombolysis instead of catheter-directed thrombolysis.</td>
<td>In high-risk PE, recommend rapid initiation of unfractionated heparin administered intravenously and systemic thrombolysis.</td>
</tr>
<tr>
<td></td>
<td>If hemodynamic compromise is present, recommend thrombomodulin is followed by anticoagulation of anticoagulation alone.</td>
<td>If thrombomodulin is used, suggest systemic thrombolysis instead of catheter-directed thrombolysis.</td>
<td>In presence of contraindications to or failed systemic thrombolysis, recommend surgical pulmonary embolectomy and consider percutaneous catheter-directed treatment.</td>
</tr>
<tr>
<td>Use of inferior vena cava filter</td>
<td>Recommend against inferior vena cava filter in patients who can receive anticoagulation.</td>
<td>Suggest that inferior vena cava filter not be used in patients who can receive anticoagulation.</td>
<td>Recommend against inferior vena cava filters; consider absolute contraindications to anticoagulation or preference despite therapeutic anticoagulation are present.</td>
</tr>
<tr>
<td>Duration of anticoagulation, including cancer-associated PE</td>
<td>Recommend 3 mo anticoagulation for primary treatment. In PE provoked by major transient risk factor, recommend stopping anticoagulation at 3 mo. If unprovoked PE or PE provoked by persistent risk factor, recommend extended-phase anticoagulation with direct oral anticoagulant; suggest reduced-dose instead of full-dose apixaban or rivaroxaban. If patient cannot receive direct oral anticoagulant, suggest extended-phase anticoagulation with vitamin K antagonist. If patient has active cancer without high bleeding risk, recommend extended anticoagulation instead of stopping anticoagulation at 3 mo. In high-risk PE, recommend extended anticoagulation at 3 mo. If patient has active cancer without high bleeding risk, recommend extended anticoagulation instead of stopping anticoagulation at 3 mo.</td>
<td>Suggest 3 to 6 mo of anticoagulation instead of 6 to 12 mo for primary treatment. Suggest indefinite anticoagulation if PE is unprovoked, provoked by chronic risk factor, or patient had previous episodes of unprovoked VTE. If bleeding risk not high and patient prefers to stay on anticoagulation, suggest standard-dose or lower dose direct oral anticoagulant.</td>
<td>For first PE provoked by major transient or reversible risk factor, recommend stopping anticoagulation after 3 mo. For recurrent VTE (≥1 previous episode of PE or deep-vein thrombosis) unrelated to major transient or reversible risk factor, recommend indefinite duration of anticoagulation. For antithrombotic syndrome, recommend treatment of indefinite duration with vitamin K antagonist.</td>
</tr>
<tr>
<td></td>
<td>For first PE provoked by major transient or reversible risk factor, recommend stopping anticoagulation after 3 mo.</td>
<td>For first PE provoked by major transient or reversible risk factor, recommend stopping anticoagulation after 3 mo.</td>
<td>For first episode of PE without identifiable risk factor, persistent risk factor or other than antithrombotic syndrome, or minor transient or reversible risk factor, consider treatment of indefinite duration with oral anticoagulation if patient does not have cancer and is receiving extended oral anticoagulation, consider low-dose direct oral anticoagulant (apixaban or rivaroxaban) after 6 mo of therapeutic anticoagulation if patient has cancer, consider extended anticoagulation for indefinite period or until cancer is cured.</td>
</tr>
<tr>
<td><strong>Use of inferior vena cava filter</strong></td>
<td>Recommend against inferior vena cava filter in patients who can receive anticoagulation.</td>
<td>Suggest that inferior vena cava filter not be used in patients who can receive anticoagulation.</td>
<td>Recommend against inferior vena cava filters; consider absolute contraindications to anticoagulation or preference despite therapeutic anticoagulation are present.</td>
</tr>
</tbody>
</table>

* These guidelines do not include management of pulmonary embolism (PE) and venous thromboembolism (VTE) risk during pregnancy planning, pregnancy, and postpartum; these specialized topics have been addressed in other guidelines.20,25

† Recommendations are based on a Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach; the strength of the recommendations are categorized as strong (phrased in the American College of Chest Physicians guidelines as “we recommend”) or weak (phrased as “we suggest”).30

§ Recommendations are based on a GRADE approach; recommendations are labeled as strong (phrased in the American Society of Hematology guidelines as “the guideline panel recommends”) or conditional (“the guideline panel suggests”).30

The level of evidence and the strength of the recommendations were weighted and graded according to predefined scales. Recommendations are expressed as: class I, in which the evidence or general agreement (or both) is that a given treatment or procedure is beneficial, useful, and effective (phrased in the European Society of Cardiology guidelines as “is recommended”), class II, in which there is conflicting evidence or divergence of opinion (or both) about the usefulness or efficacy of a given treatment or procedure, class III, in which the usefulness or efficacy is less well established by the evidence or opinion (“may be considered”), and class IV, in which there is evidence or general agreement that a given treatment or procedure is not useful or effective and in some cases may be harmful (“is not recommended”).
lism, the long-term risk of recurrence is high and indefinite anticoagulation therapy is recommended.\(^\text{2,4-6,39}\)

Decision making is more nuanced in patients with a first pulmonary embolism that was unprovoked or weakly provoked (i.e., associated with a minor transient risk factor, such as estrogen therapy, pregnancy, minor surgery, or minor leg injury).\(^\text{39}\) Although some guidelines suggest a recommendation of 3 months of anticoagulation therapy based on findings from randomized trials indicating that low-dose direct oral anticoagulant treatment is associated with a lower-than-expected incidence of recurrent venous thromboembolism (RTE) and greater effectiveness than aspirin,\(^\text{40,41}\) low-dose regimens have not been assessed in patients with cancer, in those with anatomically extensive pulmonary embolism, or in those at high risk for recurrent pulmonary embolism. Factors that may influence the choice of indefinite anticoagulant regimen are shown in Table S2.

**Other Testing**

Oncocyt is detected in 5.2% of patients with acute pulmonary embolism within 1 year after a diagnosis of unprovoked pulmonary embolism.\(^\text{42,43}\) An extensive screening strategy may detect more cancers than limited screening, but data are limited as to whether such screening is associated with better outcomes in patients with low-risk subsegmental pulmonary embolism.\(^\text{44-46}\) Experts recommend limited cancer screening guided by medical history, physical examination, basic laboratory tests and chest radiographs, and age-specific and sex-specific cancer screening.\(^\text{47}\)

Patients should be evaluated 3 to 6 months after acute pulmonary embolism is diagnosed to assess for dyspnea or functional limitation, which may indicate the development of post-pulmonary embolism syndrome or chronic thromboembolic pulmonary hypertension.\(^\text{48}\) If a decision is made to continue anticoagulation indefinitely, the patient should be reassessed annually or more often; anticoagulation may need to be discontinued if the risk of bleeding increases, a major bleeding event occurs, or the patient prefers to stop treatment.

**Conclusions and Recommendations**

The patient with breathlessness described in the vignette was estimated to have greater than a 15% likelihood of pulmonary embolism. In the context of the patient’s low Wells score for pulmonary embolism, d-dimer testing was warranted to guide the need for imaging. CT is indicated, given the d-dimer level of more than 1000 ng per milliliter. Under the presumption that the patient’s CT scan confirms pulmonary embolism and shows normal right-ventricle dimensions, he would be classified as having a low-risk pulmonary embolism, given his normal clinical presentation. Treatment with an oral anticoagulant should be started promptly, and the patient should be given information about the pulmonary embolism diagnosis. In the absence of contraindications to treatment on an outpatient basis (no Hestia criteria present), the patient can be discharged directly from the emergency department with prompt clinic follow-up.

We would recommend that he undergo cancer screening appropriate for his age and personal risk. After the patient receives 3 to 6 months of therapy with a direct oral anticoagulant administered at a treatment-level dose, in the absence of an increased bleeding risk and considering our preferences, we would recommend switching to a low-dose direct oral anticoagulant on a long-term basis for secondary prevention.

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

**Guidelines**

Current guidelines for pulmonary embolism management include those issued by the American College of Chest Physicians (ACCP),\(^\text{49}\) the American Society of Hematology (ASH),\(^\text{50}\) and the European Society of Cardiology (ESC).\(^\text{51}\) A summary of the key recommendations in these guidelines is provided in Table 2. Our recommendations align with these guidelines, which are largely concordant but differ in the strength of their recommendations for some topics. ACCP and ASH guidelines recommend anticoagulation be stopped at 3 months in the case of a first pulmonary embolism provoked by a weak transient risk factor, a recommendation not made in ESC guidelines, which suggest that indefinite anticoagulation be considered in such patients. Our approach to this situation generally aligns with the ACCP and ASH guidelines while taking into account factors that influence the risk of recurrence (e.g., male sex or older age) and patient preference.

**Areas of Uncertainty**

Appropriate management of subsegmental pulmonary embolism (a single isolated subsegmental pulmonary embolus or multiple emboli, without the presence of pulmonary embolism in the legs) is uncertain. Although some guidelines suggest clinical surveillance instead of anticoagulation in patients with low-risk subsegmental pulmonary embolism, a recent prospective cohort study involving patients who were treated without anticoagulation therapy showed a higher-than-expected incidence of recurrent venous thromboembolism during 90-day follow-up.\(^\text{52}\) A randomized, placebo-controlled trial of clinical surveillance as compared with anticoagulation in this patient population is ongoing (ClinicalTrials.gov number, NCT02463038).

Whether a particular direct oral anticoagulant is time anticoagulation is recommended in patients with cancer, in those with anatomically extensive pulmonary embolism, and shows normal right-ventricle dimensions, he would be classified as having low-risk pulmonary embolism, which is associated with a lower-than-expected incidence of recurrent venous thromboembolism (30-day follow-up).\(^\text{53}\) A randomized, placebo-controlled trial of clinical surveillance as compared with anticoagulation in this patient population is ongoing (ClinicalTrials.gov number, NCT02463038).

Whether a particular direct oral anticoagulant is indicated for treatment of such patients (NCT03285438). A multicenter, randomized, controlled trial is under way to assess the efficacy and safety of a therapy involving a reduced dose of thrombolytic medi- cation in patients with intermediate-risk acute pulmonary embolism (NCT04430569). High-quality data are needed to inform the benefits and risks of intravascular thrombolysis and clot-retrieval approaches in the treatment of patients with pulmonary embolism.

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