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September 3, 2020

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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

Eyeing Physician Career Boost Via Formal Business Education

Getting a business degree can be highly rewarding, but planning and foresight are essential

By Bonnie Darves

Physicians pursue formal business education for a whole host of reasons, but there are some common threads. For many, it's a desire to effect change within their organizations or even health care delivery as a whole. For others, a master of business administration (MBA) or master of medical management degree (MMM), or the Certified Physician Executive (CPE) credential, is viewed as a way to better position them as credible participants in big-picture discussions about organizational direction or in decisions that affect their professional lives or their specialty's future.

Increasingly, especially in large organizations, the business degree may be a requirement for seeking a senior leadership position. Some physicians have a specific reason for getting an MBA or MMM, such as launching a new clinical service. A final subset of physicians obtains formal business education as a first step toward exiting clinical medicine and moving wholesale into a nonclinical leadership role.

For internist Pamela Sullivan, MD, MBA, the driver was twofold. She needed a better understanding of the business world to help her perform more effectively in the leadership realm in which she was already functioning as a medical director. She also wanted to make a better-informed decision about how to focus the rest of her career.

"I realized that I needed to know more, and that I needed to be able to speak the [business] language whether I was in a clinical meeting or a business meeting," said Dr. Sullivan, who is chief clinical officer of implementation for Landmark Health, which partners with health plans and uses a "house calls" model to care for patients with multiple chronic conditions. "The MBA program gave me the confidence I needed to do that."

Dr. Sullivan opted for the one-year physician executive MBA program at the University of Tennessee's Haslam School of Business. In part, she chose it because it was shorter than some MBA programs, but also because she wanted a practical curriculum and the face-to-face experience of the four weeks of onsite residence. "I learn by doing, and this program was not

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about taking exams — we got real-life practical assignments. It was so energizing,” Dr. Sullivan said.

Andrew Furman, MD, MMM, took a more stepwise, protracted approach to getting his master’s in medical management. The emergency medicine physician started by taking courses through the American College of Healthcare Executives and the American Association for Physician Leadership (AAPL) over a few years. He then carried those credits into the MMM program at University of Southern California (USC) in Los Angeles, which he completed in 2017. Today, after stints at Geisinger Health System, and Salem Health in Oregon, he is medical director for Accolade, Inc., an innovative private care-delivery and benefits company serving self-insured employers.

The slower approach enabled Dr. Furman to initially select courses on topics that related to issues he was encountering in his work, while allowing him to accrue credits toward an eventual master’s degree. “I started piecemeal when I was three years out of residency and was doing committee work. The AAPL courses were fantastic because they set me on a path to a one-year USC program,” Dr. Furman said.

From the outset, Dr. Furman was clear about his motivation for learning about business: “I wanted to be part of the change in health care, and any change that occurs affects physicians,” he said. “If you just want the three letters after your name, you might not get much out of it. If you want to shake up the mess we’re in in health care, you will.” For Anil Singh, MD, MPH, MMM, executive medical director of clinical transformation at Highmark Health and system division director of Critical Care at Allegheny Health Network in Pittsburgh, Pennsylvania, the decision to obtain a business degree arose in part out of frustration. “I was being asked increasingly to do things that did not involve patient care, and to help fix issues,” said Dr. Singh, who obtained his MMM from Carnegie Mellon University. Business people sometimes asked him to write a pro forma or show ROI [return on investment] when he proposed a solution.

“I had no idea what they were talking about and decided I needed to understand the jargon. Being in the program opened up a different side of my brain that I’d never used before,” Dr. Singh said. “Now, when I speak to businesspeople in their own language, I’ve got immediate ‘street cred.’”

Benefits of business education: professional and personal

Like Dr. Singh, other physicians interviewed for this article were unanimous on one key benefit of formal business education: becoming conversant in the language spoken in board rooms and management meetings.

“I knew that if I was going to be communicating with CEOs and CFOs, and marketing directors, I needed to understand their language — and I needed the credentials and knowledge to participate effectively. The MBA gave me that confidence,” said anesthesiologist Talal Ghazal, MD, MBA, co-director of the Holy Cross Hospital Pain Center in Wheaton, Maryland. “I also wanted to learn about something I wasn’t trained in. I found that business is no big mystery — it’s a matter of understanding the fundamentals and concepts.”

Physicians who pursued MMM and MBA degrees that included an onsite component also cited interactions and continued networking with their cohort members as a major benefit.

“Working on an MBA, MMM, or CPE helps you develop a network of colleagues with similar goals or interests, who become an ongoing resource for advice or counsel,” according to John Jurica, MD, MPH, CPE, medical director of an Illinois urgent care network who blogs and delivers podcasts on physician leadership.

For Dr. Furman, the networking was especially gratifying. “The cohort experience was amazing. You learn so much from being in the room with people with varied backgrounds who often are experiencing similar issues,” he said. The diverse specialty and background profiles of a typical MBA cohort enrich the learning experience, notes Kate Atchley, PhD, executive director of the University of Tennessee’s Physician Executive MBA program. “In a typical year, we’ll draw physicians who are entrepreneurial-minded, some who are in mid-career or are already in administrative positions who want business acumen, and younger physicians who know that medicine is changing and want to be part of that change,” she said. “The benefit of the physician-only environment is that the students come in with the same educational background and the same experience of clinical work — they can relate to each other.”

Dr. Singh’s cohort, for example, included hospitalists, internists, cardiologists, a pathologist, and a palliative medicine physician. “Learning from the other physicians was a phenomenal experience,” he said.

Rex Kovacevich, MBA, a professor of clinical marketing in USC's MMM program, sees those valuable interactions firsthand. He often witnesses physicians sharing their stories and experiences, and in doing so, helping each other deal with situations in their own organizations or professional lives. "That's one of the key benefits of the cohort model — the physicians become comfortable sharing with each other," said Mr. Kovacevich. Monique Butler, MD, MBA, chief medical officer for Swedish Medical Center, in Englewood, Colorado, cites those networking benefits and the resulting relationships she built as an important outcome of her participation in the University of Tennessee's Physician Executive MBA program. "The cohort experience gives you a huge support network. We're able to just pick up the phone and call each other when we're working through a challenge," she said. "It's been incredibly helpful."

Weighing the education options

The chief decision physicians face when they decide to pursue business education is choosing which route to take. The formal physician executive MBA, MMM, and CPE programs teach similar content, but their formats differ. The traditional MBA program, offered online or in a hybrid online/on-campus format, or as an immersive on-campus experience, ranges from one to two years and focuses on business theory, concepts, and principles. There are more than two dozen traditional MBA programs that have a health care business or leadership focus. Several universities now offer physician-only executive MBA degrees structured to accommodate the schedule constraints of practicing physicians and to deliver targeted content. Programs developed as part-time offerings often impose a maximum time for completion.

The MMM, a more recent entrant in the business-degree realm, is designed specifically for physicians and typically targets those who are at least three years out of residency. Physicians who pursue an MMM often end up serving as medical directors, department chairs, chief medical officers, or president/vice president of medical affairs. The programs run 12 to 18 months, and prerequisites might be required. These programs incorporate online learning and an onsite residential component several times annually. Common courses include organizational management, health economics, health policy, health finance, health law, and operations management.

Maeleine Mira, director of the MMM program at USC's Marshall School of Business, said that a key feature of the MMM curriculum is that it's designed to teach students how the business cases apply in health care. "That's one of the benefits of the MMM compared to traditional MBA programs," she said. "Every student graduates with an implementable capstone, so that they're ready to go back and institute changes." USC also offers a pre-MMM fellowship option for final-year residents.

When considering any MBA or MMM program, prospective participants should carefully evaluate the content focus to choose a program that suits their individual needs or career objectives, several sources pointed out. Physicians should also keep in mind that some programs require that participants have three to five years of clinical experience post-residency.

The CPE that AAPL offers focuses heavily on both business content and leadership training and is pursued on a course-by-course basis in a 150-credit curriculum consisting of online learning and live events. The focus is on hands-on learning. The CPE offers flexibility for participants who might need to complete the curriculum at an uneven rate or over a longer period, and it requires a final capstone project and audiovisual presentation. A sophisticated technology platform facilitates interaction among learners, and AAPL also provides professional development resources such as career assessment and executive coaching.

Typically, physicians earn their CPE designation in two to 2½ years, according to Peter Angood, MD, AAPL's president and chief executive officer. AAPL also partners with five universities to enable students to complete prerequisites toward master's degrees and easily transition into those programs.

Other degrees that include some business content include the master in healthcare quality and safety management (MS-HQSM) and master of science in the science of healthcare delivery (MS-SHCD), as well as clinical informatics degrees. The master of health administration also includes business principles but focuses on applied health care experience.

When choosing a degree program, especially an MBA, physicians should be fairly clear about what they want to achieve, Dr. Jurica advises, in part because of the financial investment. That might range from under \$10,000 for an online-only program to \$100,000 for a big-name university MBA. The CPE path is generally less expensive than the traditional MBA or MMM program, he added. "It might be worth waiting to start a program, if there's a way to get your employer to help with the costs," Dr. Jurica said.

He also advised physicians who aren't ready to commit to a program to consider taking business courses through the AAPL, specialty organizations, online programs, or local education institutions.

"It's important to decide whether you need the name recognition — which might be the case for those who will compete for a senior management position at a large organization — or just the degree and the core business knowledge," Dr. Jurica said. In the latter case, an economical online program might suffice.

What to expect

The prospect of continuing clinical practice while obtaining a business degree can be daunting, but it's doable for physicians who organize their time efficiently and strategically, sources agreed. The MBA and MMM programs typically carry a workload of 12 to 25 hours weekly, in addition to the onsite periods.

Physicians who want to get a business degree should plan well in advance, all sources said, and should ensure they will have support from their families, colleagues, and organizations before they start. Ideally, they should also try to either reduce or reconfigure their clinical hours to accommodate program demands. "The most important aspects of preparing for a graduate business degree are figuring out how you'll arrange your time when you add the program to your other responsibilities and making sure that those close to you — your spouse, your coworkers, your children — are onboard," said Mr. Kovacevich.

That's one reason that Dr. Ghazal, who obtained his health care MBA from George Washington University in Washington, D.C., encourages physicians who are eyeing a specific role to consider getting a degree earlier in their careers. "By the time you get to mid-career, and have a demanding practice and a family, it can be a challenge to fit it in because of the time requirements — you basically have a deadline every week."

Deborah Vinton, MD, medical director of the emergency department at the University of Virginia in Charlottesville, found herself on a crash course path when she began the University of Tennessee Physician Executive MBA, five years after finishing residency. She started the program just six weeks after delivering her third child. Despite the logistical challenges, the timing

was important: she had an opportunity to participate in planning the UVA's new emergency department and needed business credentials to be effective.

"I wanted to be a physician leader at this academic center, and I knew I needed this education," Dr. Vinton said. The school and her cohort were "amazingly supportive," she said, and she was able to bring her infant daughter with her for the onsite residency portions. "I was surprised by how accommodating everyone was — I didn't expect that," she said.

For Jamie Eng, MD, MMM, who completed her MMM at USC as a continuation of the administrative emergency fellowship that program offers, the degree better equipped her for the administrative work she was already doing at USC-Los Angeles County Medical Center. "It was fortuitous because the fellowship actually required me do the MMM. I looked at other administration fellowships, but this was such a good fit that I decided I might as well get the degree," said Dr. Eng, who is associate medical director of emergency medicine at Providence Tarzana Medical Center in Tarzana, California, and director of the USC Administrative Emergency Medicine Fellowship program.

"The cohort was fantastic," Dr. Eng said. "I feel like my administrative experience was sped up by a decade learning from the experiences of others."

Tips for choosing a program and planning the journey

Physicians interviewed for this article offered the following additional guidance for their colleagues planning to pursue formal business education:

"When you're evaluating programs, look at how the curriculum and the schedule can intersect with your job. If you're not able to merge your work with the requirements, you might have to consider other options." — Deborah Vinton, MD, MBA

"I think it's important to get awareness of the various learning opportunities, so that you have a better sense of what you want for your professional growth." — Peter Angood, MD, AAPL president and CEO

"When you're looking at programs, be clear about your career and where you want to be in five years — and how a particular program or fellowship is going to get you there." — Jamie Eng, MD, MMM

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“You must be able to make the commitment before you start a program. You need a game plan, the financial resources, and the buy-in from family and colleagues. I ended up devoting two full days a week to my studies.” — Pamela Sullivan, MD, MBA

“Truly understand the time commitment. Programs might cite a certain number of hours per week but assume that that’s the minimum. It might take more time to meet your requirements.” — Talal Ghazal, MD, MBA

“Do the degree at the right time in your career. It’s important to be a good doctor first and to have that credibility. I think five years in practice is the minimum, and that seven to 10 might be the sweet spot.” — Anil Singh, MD, MPH, MMM

Physician Employment Contracts: Strategies for Avoiding Pitfalls

By Bonnie Darves

As physicians increasingly opt for practice opportunities in employed-model arrangements, and hiring entities move toward standardizing employment contracts to simplify matters and ensure equitable treatment of existing and incoming physicians, it might appear that there’s scant room for negotiating contract terms.

That’s not a prudent attitude to take about such an important document, contract lawyers maintain. That employment agreement not only dictates the next year or two of a physician’s career but also could potentially negatively affect his or her personal and professional life for years into the future. Benjamin J. Mayer, JD, MBA, a Denver lawyer whose firm specializes in physician contracts, advises physicians to take the position that any terms that aren’t favorable can — and should — be made more reasonable. “The physician might not be able to get a higher starting salary or a larger signing bonus but definitely should negotiate anything that’s explicitly unfair or clearly intentionally ambiguous,” Mr. Mayer said.

Key examples he cites are contracts with onerous non-compete provisions that would prevent a departing physician from working within, say, a 60-mile radius of any of the employer’s locations, or contracts that contain little detail about weekly work hours and schedules, or call requirements. Essentially, anything that is vague or an overreach should be modified and specified. “The physician needs to require reasonable boundaries on all of the contract’s terms,” Mr. Mayer said. For example, any non-compete radius should be drawn from a single primary location, not from all of a sprawling mega-health system’s hospitals and clinics. Similarly, regarding schedules, the contract should at least specify a cap on total weekly hours or days worked and should dictate an equitable call schedule.

“Duties, hours, and responsibilities should be spelled out, and if the call coverage isn’t specified, the contract should at least state that those duties will be ‘equally divided among all physicians’ in the group,” Mr. Mayer said. He acknowledged that some young physicians might be willing to shoulder commensurately more call duty than their peers if they’re trying to pay off medical school loans, for example, but such special arrangements are best addressed outside of the contract.

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Michael Schaff, cochair of health law for Wilentz, Goldman & Spitzer, P.A. in Woodbridge, New Jersey, suggests that young physicians in surgical and other call-intensive specialties should determine whether practice culture or bylaws issues might translate into an inordinate call burden that they're not willing to assume. For example, Mr. Schaff noted, some practices enable physicians who reach a certain age — 55 or 60 is common — to opt out of call altogether. If several senior doctors stop taking call, younger physicians' "equally divided duties" might be unmanageable. To be safe, the contract should specify a "not to exceed" number of call days per week or month, Mr. Schaff and other sources advised.

Emerging "super groups" affect contracts

On a global scale, practice acquisition and management trends — specifically, the growing influence of private equity on physician practice and facility management and the creation of huge organizations that operate scores of groups — are affecting physician employments. Rebecca Gwilt, a Richmond, Virginia, lawyer and partner in Nixon Law Group, said she is witnessing a "trickle-down effect" on contracts as private equity-operated super groups emerge.

"We're seeing a more sophisticated framework for physician contracts," Ms. Gwilt said, as well as a tendency toward both shorter employment terms and slimmer benefits. "Legally, these companies aren't permitted to influence the delivery of services, but in general, they're non-physician companies, which means that the MBAs are making contract decisions, not physicians," said Ms. Gwilt, who frequently speaks on physician contract issues. "So, as this [model] becomes more common, market salaries and benefits could change."

Although the trend toward super-group formation isn't inherently negative — such groups have more bargaining power regarding physicians' reimbursement rates than smaller ones do, generally — it does call for due diligence and research on the part of physicians who consider interviewing with such entities. "You first should find out who runs the company, because you will have less room to negotiate a contract than with a physician-owned practice," Ms. Gwilt said. "You want to know what it's like to work there, so I advise clients to ask for the name of the last physician hired — someone who's been there for a year — and then talk to that physician."

The movement toward "corporatization" of medicine, in tandem with the fluctuating health care economic, reimbursement, and policy environment, is prompting employers to reduce their financial risk wherever possible. One example is instituting shorter contract employment terms, which enables employers to more easily let go of poor-performing physicians. Another recent development is the setting of limits on how much individual physicians can earn, regardless of their productivity, according to Kyle Claussen, CEO of Resolve Physician Agency, a Missouri-based firm that counsels physicians on contract issues.

"It's becoming more prevalent to see clauses with caps on compensation, such as the 75th or 90th percentile in a major national survey such as the Medical Group Management Association survey," Mr. Claussen said. Although such caps aren't likely to affect most physicians coming out of residency because starting salaries are rarely set at those percentiles, the caps could penalize high-income specialties such as neurosurgery and orthopedic surgery as those physicians move into their second and third years of practice. "I've seen some high-income specialists walk away from those potential jobs," he said. He added — and other sources concurred — that sign-on bonuses are less common now than they were a few years ago, possibly for some of the same economic reasons.

Another contract area where shifts are occurring involves bonuses and productivity-based compensation, several sources mentioned. As employers, as well as government and commercial insurers, move toward providing monetary incentives to physicians for performance on measures ranging from patient satisfaction to hospital readmissions, it's important to know how such payments are handled on the employer side. This is particularly the case with any bonuses or incentive payments that may be due a physician, Mr. Schaff pointed out.

For example, if the contract states that incentives and bonuses are paid only through the employment period or only at the end of a calendar year, the physician might lose out on a substantial sum if he or she leaves the job on, say, Dec. 22, rather than Jan. 1 of the following year. Ideally, the contract should call for payment of "all bonuses earned through the time of termination."

Ditto for accounts receivable monies that physicians might be due. It's very common for such monies to continue flowing to the practice for several months after a physician departs, so ideally, Mr. Schaff suggested, the contract should call for reporting on such funds for a specific period after

termination and ultimately paying out what's due at, say, 60, 90, or even 180 days post-termination of employment. "This is all over the map in contracts I've seen," Mr. Schaff said. "I've even seen contracts that state that the physician only receives payments through the last day of employment. This is something that should be negotiated."

At the other end of the spectrum, physicians whose contracts set minimum or expected productivity or quality performance targets in order to continue the base salary beyond year one should understand not only what those requirements are but also — and more importantly — whether they're achievable and reasonable. That means talking to other physicians at the prospective practice to see how they've fared in year two in productivity. It's also helpful to find out how much personal effort is required to track the performance metrics that underlie performance payments, several sources advised. Mr. Mayer said that when a base salary arrangement converts to a totally productivity-based one at the end of the first year, he often negotiates for something less dramatic, such as continuation of the base salary for an extended period or and perhaps a part-base/part-productivity structure.

"The point is that your contract governs how your money works, and compensation structures are becoming increasingly complicated," Ms. Gwilt said. "That's why it's really important that physicians understand those structures and obtain legal review." It's not uncommon for compensation methodologies to incorporate a half-dozen components beyond base salary, such as incentive bonuses or "clawbacks" (monies returned to the employer for underperformance or other reasons) based on quality measures, cost metrics, patient-specific clinical measure reporting, compliance, and shared-savings, to name a handful.

On a final note, all sources stressed the importance of physicians reading every word of the contract and obtaining expert review. The point is to make sure that physicians understand what the contract entails and what its provisions would look like in their daily lives, by requesting specific examples of not only what's expected of them but also what might happen should they leave the position prematurely. "One thing that physicians need to think about but are reluctant to ask is this: What happens if they want to get out or if the employer wants to terminate the contract?" Ms. Gwilt said. "If there's a penalty clause, that should be highly negotiated."

Contract pitfalls to watch for

Contract language that's vague and highly employer favorable. Such language might show up in any area of the contract, but it's especially problematic when it comes to physician schedules and duties, according to Ms. Gwilt. "You want to beware of anything that states, 'X will be determined by the practice at its discretion,'" she said. That leaves the physician open to whatever the employer decides at any time during the contract period. At the least, physicians should negotiate to add that the terms be "fair and reasonable, and in accordance with [requirements] for all like colleagues."

Mr. Mayer provides an example of where "at the practice's discretion" could have a serious lifestyle effect: unspecified practice locations. As organizations merge and/or add satellite facilities, a vague location clause might mean that physicians could be required to commute to or travel among four different clinics or hospitals. Mr. Mayer suggests that physicians ask prospective employers to specify locations and limit their number contractually, or at least give the physician the opportunity to decide if she or he is willing to expand the number.

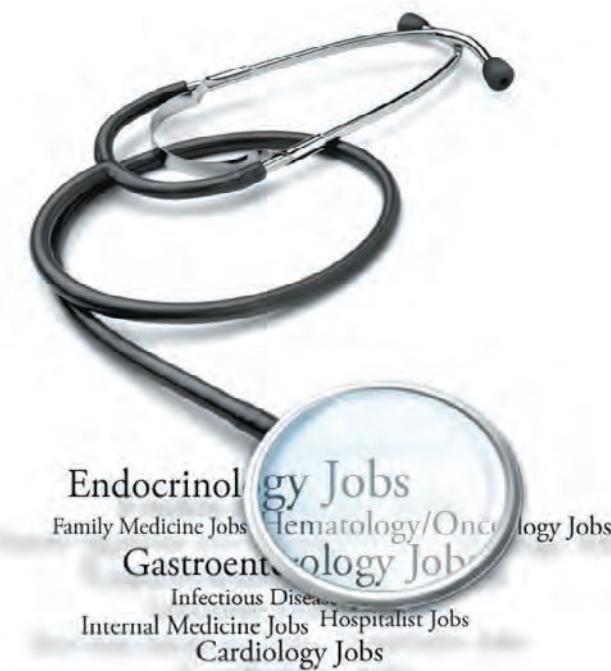
Highly restrictive non-compete clauses. Syracuse, New York, attorney Andrew Knoll, JD, MD, cautions physicians to beware of and negotiate onerous non-compete terms when employers aim to keep physicians from working for a slew of specific competitors. "I've seen clauses that state, 'Within two years of leaving the practice, the physician cannot work for health system Y or hospitals A, B, or C.' That's overly broad. Others might restrict the employee from going to a particular large health system, but not to smaller hospitals or systems in the same urban area," Mr. Knoll said. "These clauses should always be reviewed."

Unreasonable benefit start dates. One pitfall with benefits is not ensuring that they commence at a reasonable time, Mr. Schaff observed. For example, if a contract stipulates that that health insurance benefits start on the first day of the month following hiring or 90 days hence, he said, "The physician could be on the hook for paying the premiums for COBRA [continued coverage from the previous employer]. At the least, if the benefits start date can't be modified, the incoming physician might try to negotiate that the employer pay the COBRA premiums until the coverage starts."

Onerous — or unspecific — indemnification or liquid damages clauses, especially regarding malpractice claims. The first order of business here is to understand any limitations that employer-paid malpractice coverage

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might have, and then ensure that the employed or contracted physician isn't on the hook fully for additional damages that the policy doesn't cover, Mr. Mayer advised. For example, if the malpractice coverage tops out at \$1 million and the judgment comes in at \$1.25 million, some contracts might shift the entire shortfall to the physician, explicitly or not so explicitly. "Such a provision might say that 'the practice and the doctor agree to indemnify and hold each other harmless for any liability caused by the other,'" Mr. Mayer said. "It sounds and seems fair, but in practice, the malpractice claim will usually follow the physician, not the practice. This is something that requires careful review and possibly negotiation."



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The NEW ENGLAND
JOURNAL of MEDICINE

CLINICAL PRACTICE

Caren G. Solomon, M.D., M.P.H., *Editor*

Acute Ischemic Stroke

William J. Powers, 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 author's clinical recommendations.

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A 62-year-old, right-handed, independently functioning man presents 1 hour after a sudden, witnessed onset of speech difficulty and right-sided numbness and weakness. He is alert with moderate aphasia, facial weakness on the right side, and weakness in the right arm and leg with decreased sensation to light touch. His blood pressure is 160/95 mm Hg, plasma glucose level 79 mg per deciliter (4.4 mmol per liter), and body temperature 37.2°C. His medical history is unremarkable, and he is taking no medications. Noncontrast computed tomography (CT) of the head shows slight hypodensity in the left insular cortex (Fig. 1A). What would you do?

THE CLINICAL PROBLEM

EACH YEAR IN THE UNITED STATES, APPROXIMATELY 700,000 PEOPLE HAVE an acute ischemic stroke.¹ Before modern treatments, early mortality was 10%.² Among survivors, one half had moderate-to-severe neurologic deficits, and a quarter were dependent on others.³ The introduction of intravenous alteplase in 1995 led to substantial improvement in outcomes.⁴ More recently, effective mechanical thrombectomy has radically altered initial management in many patients.⁵ Understanding treatment options for acute ischemic stroke is important to ensure prompt administration of appropriate care or referral.

STRATEGIES AND EVIDENCE

Treatment for patients with acute ischemic stroke is guided by the time from the onset of stroke, the severity of neurologic deficit, and findings on neuroimaging. By convention, the time of stroke onset is established as the time that the patient was last known to be well (i.e., in normal or baseline state, as confirmed by medical history). For persons who awake with stroke, this time will be sometime before they went to sleep. The severity of neurologic deficit is measured by means of the National Institutes of Health Stroke Scale (NIHSS), on which scores range from 0 to 42, with lower numbers indicating milder deficits.⁶ Deficit severity is further characterized as nondisabling or disabling if it would prevent performance of basic activities of daily living or return to work.

INITIAL EVALUATION AND IMAGING

Rapid onset of neurologic deficits localized to a single cerebral arterial vascular territory is the archetypal clinical presentation of acute ischemic stroke. The blood glucose level should be measured routinely to exclude hypoglycemia. Brain imaging is necessary to rule out intracerebral hemorrhage; noncontrast CT is preferred be-

KEY CLINICAL POINTS

ACUTE ISCHEMIC STROKE

- Treatment for patients with acute ischemic stroke is guided by the time from the onset of stroke, the severity of neurologic deficit, and findings on neuroimaging. By convention, the time of stroke onset is established as the time that the patient was last known to be well (i.e., in a normal or baseline state, as confirmed by medical history).
- Intravenous thrombolysis with alteplase (a recombinant tissue plasminogen activator) improves outcomes in selected patients with acute ischemic stroke when administered within 4.5 hours after onset. Later treatment may improve outcomes in selected patients, with the treatment window extended to 9 hours from onset.
- Intraarterial catheter-based mechanical thrombectomy of occluded large intracranial arteries improves outcomes in selected patients with acute ischemic stroke when performed up to 24 hours after onset.
- The benefit of alteplase and mechanical thrombectomy is time-dependent, so assessment and treatment should be instituted rapidly.
- In selected patients with mild acute ischemic stroke who do not qualify for intravenous thrombolysis or mechanical thrombectomy, dual antiplatelet therapy with clopidogrel and aspirin when administered within 24 hours after onset and continued for 21 days lowers the risk of recurrent stroke.

cause of its availability, rapidity, and high sensitivity. Magnetic resonance imaging (MRI) with special sequences can also be used.⁵ In clinically typical cases, a noncontrast CT that shows no other explanation for the neurologic deficit is sufficient to diagnose acute ischemic stroke on initial imaging; diffusion-weighted MRI is not necessary. Because the benefits of treatment for acute stroke are time-sensitive, initial diagnostic imaging should be performed quickly.

Further neuroimaging may be required to determine eligibility for some interventions. Noncontrast CT is used to determine the Alberta Stroke Program Early Computed Tomography Score (ASPECTS; scores range from 0 to 10 on the basis of ischemic changes in the territory of the middle cerebral artery, with 0 indicating the most extensive ischemic changes).⁷ Diffusion-weighted MRI and perfusion CT measurements are used to define ischemic brain tissue that is probably irreversibly damaged (“core”). Delayed arrival of contrast, as shown on perfusion MRI or perfusion CT, is used to define ischemic tissue that is potentially salvageable (“penumbra”). MR angiography (MRA) and CT angiography (CTA) show the location of intracranial arterial occlusions (Fig. 1B).^{8,9} In patients with renal insufficiency, time-of-flight MRA (which does not use contrast) can be used to identify arterial occlusions and inform therapeutic decisions.

MEASUREMENT OF RESPONSE TO TREATMENT

Clinical benefit is conventionally measured with the use of the modified Rankin scale, on which

scores range from 0 (no symptoms) to 6 (death). A score of 1 indicates an ability to carry out all usual duties and activities despite symptoms. A score of 2 indicates an inability to carry out all normal activities but an ability to look after one's own affairs without assistance.¹⁰

TREATMENT OPTIONS

Alteplase within 4.5 Hours after Stroke Onset

Randomized, controlled trials have shown that intravenous administration of alteplase (at a dose of 0.9 mg per kilogram of body weight over 60 minutes [maximum total dose, 90 mg], with the first 10% of the dose given as a single bolus over 1 minute) within 4.5 hours after the onset of stroke reduces disability from acute ischemic stroke.¹¹ Intravenous alteplase has shown benefit for patients with disabling stroke regardless of the NIHSS score; it is not recommended for those with nondisabling stroke and an NIHSS score of 0 to 5, for those with associated conditions in which the bleeding risk is excessive, or for those with CT evidence of extensive irreversible injury. Intravenous alteplase is considered a first-line agent in eligible patients.⁵

Before the administration of alteplase, no neuroimaging other than initial diagnostic noncontrast CT is necessary. Given the low prevalence of unsuspected coagulopathies, intravenous alteplase should be administered while the results of hematologic tests are pending if there is no reason to suspect an abnormality. On the basis of the National Institute of Neurological Disorders and Stroke (NINDS) trial protocol for

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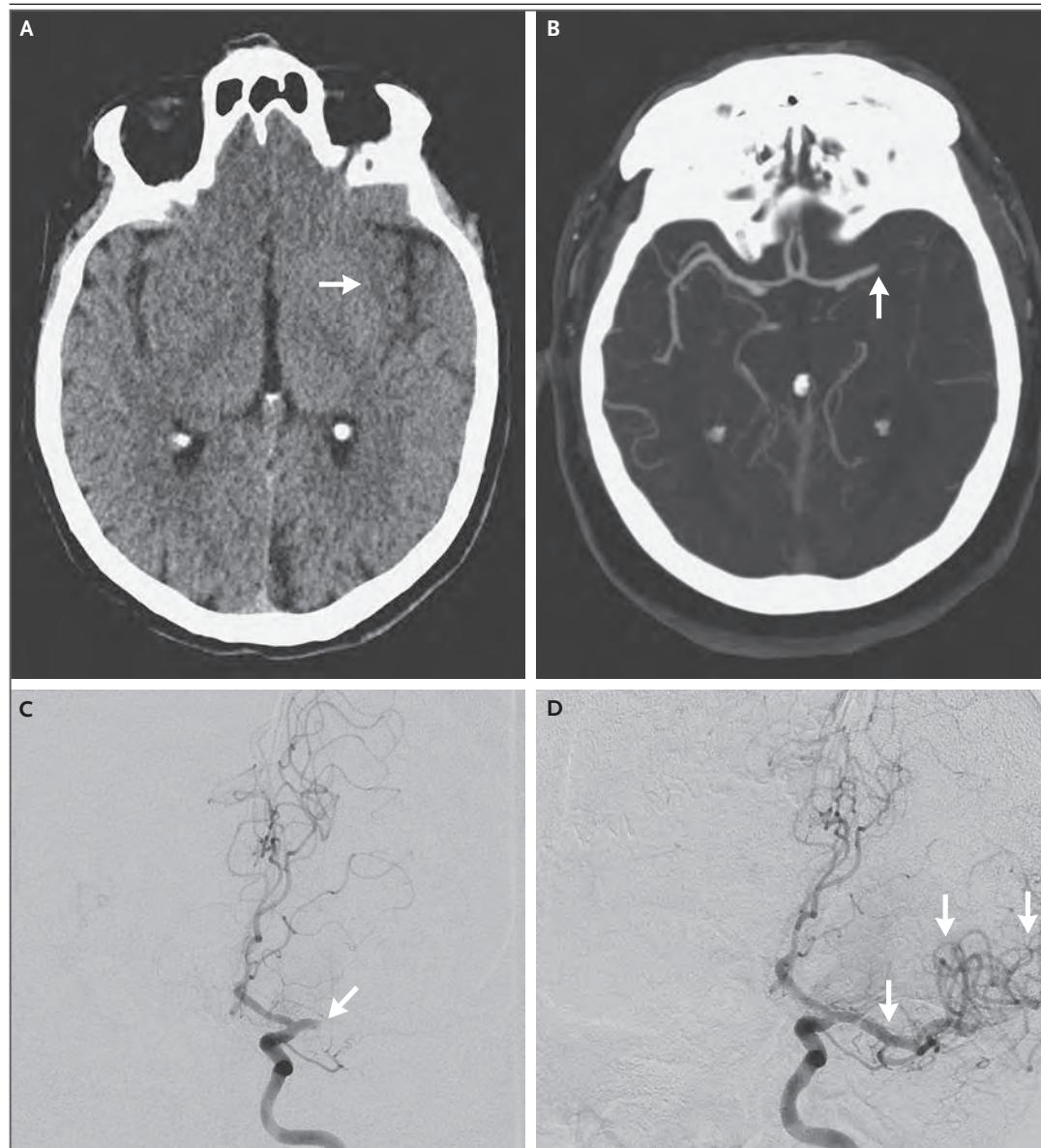


Figure 1. Neuroimaging from Patients with Acute Ischemic Stroke and Occlusion of the Left Middle Cerebral Artery.

Panel A shows a noncontrast computed tomographic (CT) scan of the head (transverse section) revealing slight hypodensity in the left insular cortex (arrow). Panel B shows a CT angiogram (transverse section) revealing an occlusion of the first segment of the left middle cerebral artery (arrow). Panel C shows a cerebral arteriogram (anterior projection) revealing an occlusion of the first segment of the middle cerebral artery before mechanical thrombectomy (arrow). Panel D shows a cerebral arteriogram (anterior projection) revealing recanalization of the left middle cerebral artery after thrombectomy (arrows).

the use of tissue plasminogen activator,⁴ the blood pressure must be lower than 185/110 mm Hg before and during infusion and lower than 180/105 mm Hg for at least the first 24 hours afterward. Patients who have received intravenous alteplase are admitted to an intensive care

unit or specialized stroke unit for close neurologic monitoring and blood-pressure control, if necessary.

The benefit of intravenous alteplase is time-dependent. In a meta-analysis of nine randomized, controlled trials,¹¹ 32.9% of the patients in

the alteplase group, as compared with 23.1% of the patients in the control group, had a favorable 3-month outcome (defined as a modified Rankin scale score of 0 or 1) when treatment was administered within 3 hours after the onset of stroke (adjusted odds ratio, 1.75; 95% confidence interval [CI], 1.35 to 2.27); the corresponding rates were 35.3% and 30.1% when treatment was administered between 3 and 4.5 hours after onset (adjusted odds ratio, 1.26; 95% CI, 1.05 to 1.51). Large intracerebral hemorrhage occurred in 6.8% of the patients in the alteplase group and in 1.3% of those in the control group. The overall outcomes, as assessed by the modified Rankin scale, among the patients in the alteplase group reflected the deleterious effects of hemorrhage along with the beneficial effect on ischemic stroke recovery.

Alteplase at More Than 4.5 Hours after Stroke Onset

In the WAKE-UP (Efficacy and Safety of MRI-based Thrombolysis in Wake-Up Stroke) trial, 503 patients with a time of onset of disabling acute ischemic stroke that was unclear, but greater than 4.5 hours from the time last known to be well (94% of whom awoke with stroke), were randomly assigned to receive intravenous alteplase at a standard dose or placebo administered within 4.5 hours after the recognition of stroke symptoms.¹² Patients were eligible if they had an abnormal signal on diffusion-weighted MRI, no visible signal change on fluid-attenuated inversion recovery imaging, a lesion on diffusion-weighted MRI that was not larger than one third of the territory of the middle cerebral artery, an NIHSS score of 25 or lower, and no planned thrombectomy. More participants in the alteplase group than in the placebo group attained the primary end point of a modified Rankin scale score of 0 or 1 at 90 days (53% vs. 42%; adjusted odds ratio, 1.61; 95% CI, 1.09 to 2.36).

Data from randomized, controlled trials that used imaging eligibility criteria support a benefit of late administration of intravenous alteplase (4.5 to 9.0 hours after the onset of stroke or measured from the mid-point of sleep). In a pooled analysis of patients with a penumbra-to-core ratio of greater than 1.2 and a core volume of less than 70 ml (as shown on perfusion CT or diffusion-weighted MRI with perfusion MRI), a greater percentage of those in the alteplase group than in the control group had a good outcome

(defined as a modified Rankin scale score of 0 or 1) at 90 days (36% vs. 29%; adjusted odds ratio, 1.86; 95% CI, 1.15 to 2.99).¹³ Enrolled patients had much larger penumbra-to-core ratios and lower core volumes than the limits set by eligibility criteria (a mean penumbra volume of 63.9 ml and a mean core volume of 8.0 ml in the alteplase group). In health care settings where mechanical thrombectomy is not available, patients who are within the treatment window of 4.5 to 9.0 hours can be considered for intravenous alteplase on the basis of the characteristics of the patients enrolled in these trials. However, mechanical thrombectomy is preferred when available.

Mechanical Thrombectomy within 6 Hours after Stroke Onset

Mechanical thrombectomy entails passing an intraarterial catheter from a peripheral puncture into an intracranial artery and removing an occluding thrombus by ensnaring it or by suction (Fig. 1C and 1D). Mechanical thrombectomy, performed within 6 hours after the onset of stroke, is another first-line treatment for selected patients on the basis of multiple randomized, controlled trials that have shown a benefit. These trials primarily enrolled patients 18 years of age or older who had a prestroke score of 0 or 1 on the modified Rankin scale, a causative occlusion of the intracranial internal carotid artery or the first segment of the middle cerebral artery, an NIHSS score of 6 or higher, and an ASPECTS value of 6 or higher, in whom treatment was initiated (groin puncture) within 6 hours after onset.⁵ MRA or CTA is necessary to show intracranial large-vessel occlusion. Two randomized, controlled trials that used only these neuroimaging methods showed a benefit of mechanical thrombectomy.^{14,15} Although other trials used diffusion-weighted MRI, perfusion MRI, or perfusion CT to determine eligibility, such testing is not required and could lead to the exclusion of patients who might benefit from treatment.

Pooled data from five randomized, controlled trials showed that the percentage of patients who had a modified Rankin scale score of 0 to 2 at 90 days was higher among those who underwent stent-retriever mechanical thrombectomy than among those who did not (46.0% vs. 26.5%; adjusted odds ratio, 2.49; 95% CI, 1.76 to 3.53).¹⁶ In both groups, 85% of the patients received

intravenous alteplase. Mechanical thrombectomy can also be performed alone in patients who are ineligible for intravenous alteplase because of the risk of bleeding. As with alteplase, the benefit of mechanical thrombectomy is time-dependent.¹⁷

These trials included few patients who had a causative occlusion of an intracranial artery other than the internal carotid artery or the first segment of the middle cerebral artery, a pre-stroke score of more than 1 on the modified Rankin scale, an ASPECTS value of lower than 6, or an NIHSS score of lower than 6; therefore, the benefits of mechanical thrombectomy are uncertain for these patients, but the procedure may be reasonable if performed within 6 hours after onset. Direct aspiration as a first approach for thrombectomy has been shown to be noninferior to stent retrievers.¹⁸ Mechanical thrombectomy should be performed by qualified neurointerventionalists with comprehensive periprocedural care teams in specialized centers where cerebral angiography can be performed rapidly.

A randomized, controlled noninferiority trial that compared mechanical thrombectomy alone with the combination of intravenous alteplase and mechanical thrombectomy in patients eligible for both interventions met its large prespecified noninferiority margin (the modified Rankin scale score with thrombectomy alone at 90 days was less than 20% worse than that with combined therapy); the adjusted odds ratio was 1.07 (95% CI, 0.81 to 1.40).¹⁹ This trial was carried out at centers where mechanical thrombectomy is performed, and the median delay from starting treatment with alteplase to groin puncture was 30 minutes; thus, the trial did not address the common scenario of initiating alteplase treatment locally, followed by transfer to another site for thrombectomy. Furthermore, all the participants had CTA documentation of intracranial large-vessel occlusion at randomization, whereas alteplase is often administered before CTA is performed. Current guidelines recommend that patients who are eligible for alteplase receive it even if mechanical thrombectomy is still under consideration.⁵ It is prudent to continue this practice until further data are available.

Mechanical Thrombectomy at More Than 6 Hours after Stroke Onset

Two randomized, controlled trials have shown a benefit of mechanical thrombectomy performed

at more than 6 hours after the onset of stroke in patients with an occlusion of the intracranial internal carotid artery or the first segment of the middle cerebral artery. The DAWN (Clinical Mismatch in the Triage of Wake Up and Late Presenting Strokes Undergoing Neurointervention with Trevo) trial used the combination of an NIHSS score of 10 or higher and findings on perfusion CT or diffusion-weighted MRI with perfusion MRI to select patients who had an onset of stroke 6 to 24 hours earlier.⁸ The percentage of patients with a score of 0 to 2 on the modified Rankin scale at 90 days was significantly higher among those who underwent mechanical thrombectomy than among those who did not (49% vs. 13%; adjusted difference, 33%; 95% CI, 21 to 44). The DEFUSE (Diffusion and Perfusion Imaging Evaluation for Understanding Stroke Evolution) 3 trial included patients who had an onset of stroke 6 to 16 hours earlier and had a large mismatch between the volume of the core and the volume of the penumbra and a maximum core size as determined by means of perfusion CT or diffusion-weighted MRI with perfusion MRI and an NIHSS score of 6 or higher.⁹ The percentage of patients with a score of 0 to 2 on the modified Rankin scale at 90 days was significantly higher among those who underwent mechanical thrombectomy than among those who did not (45% vs. 17%; relative risk, 2.67; 95% CI, 1.60 to 4.48).

There are limited data to guide blood-pressure management in patients who undergo mechanical thrombectomy. Most patients who were enrolled in randomized, controlled trials within 6 hours after the onset of stroke received intravenous alteplase. The protocols of those trials stipulated that a blood pressure of 180/105 or lower be maintained in the patient during mechanical thrombectomy and for 24 hours after the procedure, and most of the trials excluded patients who had a blood pressure of higher than 185/110 mm Hg. The most appropriate blood-pressure management in patients not receiving alteplase is not known, but it is reasonable to maintain a blood pressure of 180/105 mm Hg or lower during the procedure and for 24 hours after the procedure.⁵

Tenecteplase

Tenecteplase is a tissue plasminogen activator that is modified to be more fibrin-specific and

more resistant to plasminogen activator inhibitor and to have a longer plasma half-life than alteplase so that it can be given as a single intravenous bolus. A meta-analysis of five randomized, controlled trials that compared tenecteplase with standard-dose alteplase for the treatment of acute ischemic stroke showed no significant difference between the two agents with respect to the percentage of patients who had a score of 0 or 1 on the modified Rankin scale at 90 days (58.2% vs. 55.6%; odds ratio, 1.17; 95% CI, 0.95 to 1.44).²⁰ Conclusions regarding the relative efficacy of tenecteplase are limited owing to the absence of a rigorous, generalizable, head-to-head trial with a primary clinical end point, heterogeneity among the trials with respect to the characteristics of the enrolled patients and the tenecteplase doses, the inclusion of multiple outcomes leading to an increased risk of type I error, and wide confidence intervals in the individual trials.

Antithrombotic Agents

In patients who receive intravenous alteplase, administration of an antiplatelet agent is generally delayed for 24 hours to minimize the risk of bleeding.⁵ Pooled data from two large, randomized, placebo-controlled trials showed that the risk of recurrent stroke or death in the hospital was lower with aspirin (at a dose of 160 to 300 mg administered within 48 hours after acute ischemic stroke) than with placebo (8.2% vs. 9.1%, $P=0.001$).²¹ In patients with an NIHSS score of 3 or lower who have no indication for long-term anticoagulation, the percentage of those who had a subsequent stroke (ischemic or hemorrhagic) over 90 days was lower with a 21-day course of dual antiplatelet treatment begun within 24 hours (clopidogrel at an initial dose of 300 mg, then 75 mg per day, plus aspirin at an initial dose of 75 to 300 mg, then 75 mg daily) followed by a course of clopidogrel (75 mg daily) than with aspirin alone (8.2% vs. 11.7%; hazard ratio, 0.69; 95% CI, 0.56 to 0.84).²² This difference was maintained at 1 year (10.6% vs. 14.0%; hazard ratio, 0.78; 95% CI, 0.65 to 0.93).²³

In a meta-analysis of randomized, controlled trials involving patients with acute ischemic stroke, the risk of death or disability at follow-up with therapeutic anticoagulation within 48 hours after onset was not lower than with aspirin or placebo.²⁴ Among a subgroup of patients with

atrial fibrillation, the risk of recurrent ischemic stroke during the treatment period was significantly lower with therapeutic subcutaneous heparin (begun within 48 hours after onset and continued for 14 days) than with no heparin (2.3% vs. 4.9%); however, the risk of symptomatic intracerebral hemorrhage was higher with therapeutic subcutaneous heparin (2.8% vs. 0.4%), and the risk of death or disability at 6 months was not lower than with no heparin.²⁵

General Medical and Supportive Care

Guidelines for general medical and supportive care are provided in Table 1. An algorithm for initial management of acute ischemic stroke is provided in Figure 2.

AREAS OF UNCERTAINTY

Comparative data regarding outcomes and cost-effectiveness are needed to improve systems of care before and during hospitalization, including the use of mobile stroke units — ambulances equipped with CT scanners, in which onboard physicians or physicians available by telemedicine can use CT results to make decisions about intravenous thrombolysis or transport.²⁶ Other uncertainties include the efficacy of mechanical thrombectomy within 6 hours after the onset of stroke in patients who have a causative occlusion of an intracranial artery other than the internal carotid artery or the first segment of the middle cerebral artery, a pre-stroke score of more than 1 on the modified Rankin scale, an ASPECTS value of lower than 6, or an NIHSS score of lower than 6; appropriate imaging criteria to select patients for an extended treatment window for intravenous alteplase (4.5 to 9.0 hours after the onset of stroke); the role of tenecteplase; blood-pressure targets before, during, and after mechanical thrombectomy for those who did not receive alteplase; and management of blood pressure of 220/120 mm Hg or higher in those who did not receive alteplase or mechanical thrombectomy.

GUIDELINES

Guidelines for the management of acute ischemic stroke have been published by professional organizations in the United States, Europe, Canada, and the United Kingdom.^{5,27-30} All the guide-

Table 1. General Medical and Supportive Care for Patients with Acute Ischemic Stroke.*

Patients should be admitted to a specialized stroke unit.
 Cardiac monitoring should be performed for at least the first 24 hours.
 Supplemental oxygen should be provided to maintain oxygen saturation of higher than 94%, if necessary.
 Sources of fever (temperature >38°C) should be identified and treated. Antipyretic medications should be administered to lower temperature in patients with hyperthermia.
 Hyperglycemia should be treated to attain blood glucose levels in a range of 140 to 180 mg per deciliter, and treatment should be monitored closely to prevent hypoglycemia.
 For patients with a blood pressure of lower than 220/120 mm Hg who did not receive intravenous alteplase or undergo mechanical thrombectomy and who do not have a coexisting medical complication that requires urgent antihypertensive treatment, treatment of hypertension within the first 48 to 72 hours after the onset of stroke does not reduce the risk of death or disability.
 For patients with a blood pressure of 220/120 mm Hg or higher who did not receive intravenous alteplase or undergo mechanical thrombectomy and who do not have a coexisting medical complication that requires urgent antihypertensive treatment, the benefit of treating hypertension within the first 48 to 72 hours after the onset of stroke is uncertain. It may be reasonable to lower the blood pressure by 15% during the first 24 hours after the onset.
 In immobile patients without contraindications, intermittent pneumatic compression stockings are recommended to reduce the risk of deep-vein thrombosis.
 Screening for dysphagia can identify patients at increased risk for aspiration.
 Patients with large cerebral and cerebellar infarctions are at high risk for brain swelling and herniation during the first days. These patients should be monitored closely. Neurosurgical intervention can be lifesaving in those with early decreased consciousness. If management of malignant brain swelling is unavailable locally, patients at risk for this condition should be transferred to an institution with expertise in such management.

* These guidelines were derived from the 2019 update to the 2018 American Heart Association/American Stroke Association guidelines for the early management of acute ischemic stroke.⁵

lines recommend intravenous alteplase within 4.5 hours after the onset of stroke and mechanical thrombectomy within 24 hours after onset in patients who meet criteria consistent with those in the aforementioned randomized trials. The recommendations presented here are consistent with those guidelines.

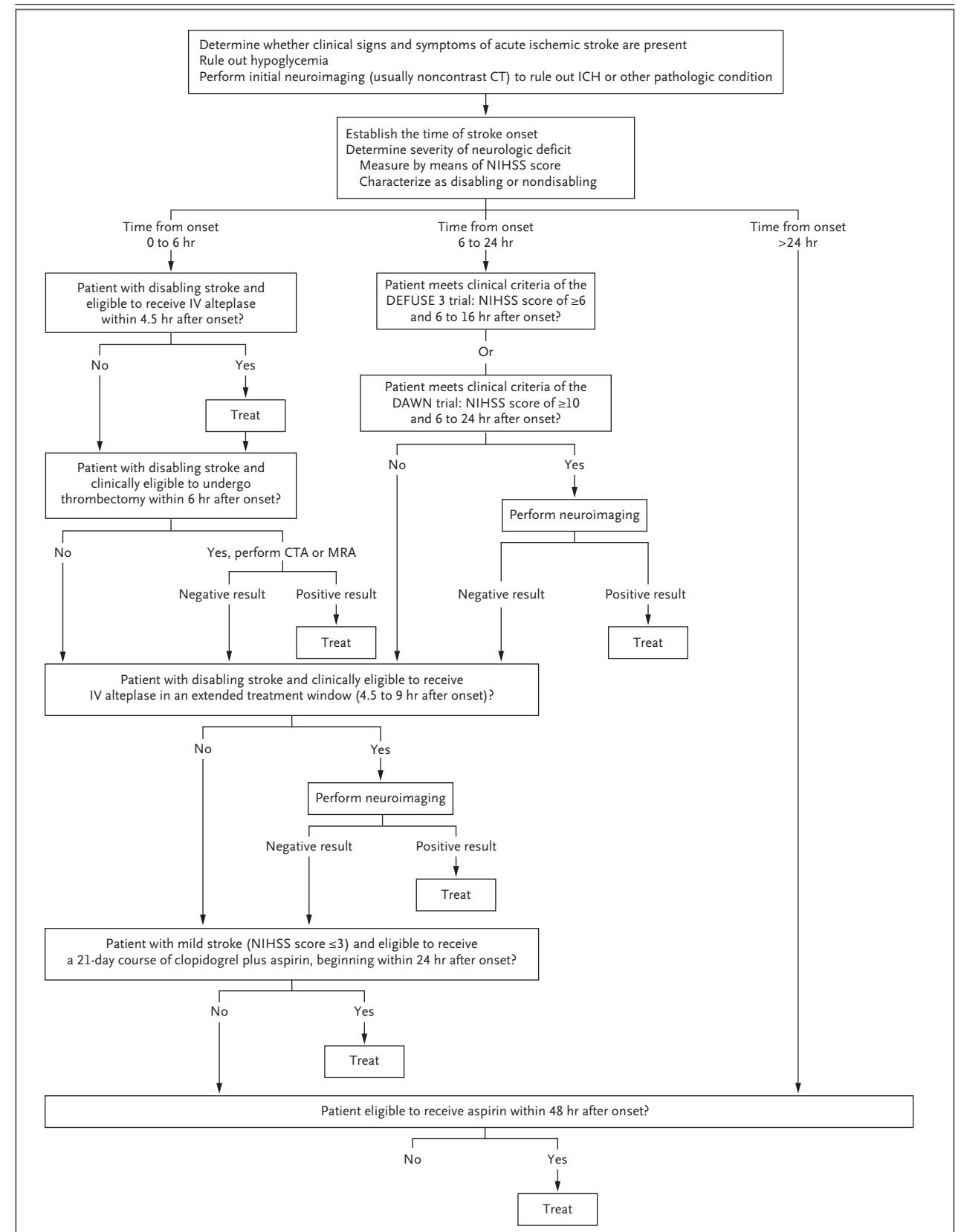
CONCLUSIONS AND RECOMMENDATIONS

The patient in the vignette has a disabling acute ischemic stroke in the territory of the left middle cerebral artery. Because the patient is within the 4.5-hour treatment window for standard intravenous alteplase and has no contraindications, he should receive intravenous alteplase immediately. CTA or MRA should be performed. If this cannot be done on site, the patient should be rapidly transferred to a hospital with resources to perform mechanical thrombectomy. If the patient has an occlusion of the internal carotid artery or the first segment of the middle cerebral artery, he should proceed immediately to undergo mechanical thrombectomy. Because the patient is within the 6-hour treatment window, no fur-

ther neuroimaging is necessary. If there is a proximal occlusion in one of the main arterial branches off the first segment of the middle cerebral artery, thrombectomy may be reasonable because of the disabling nature of his deficit. The blood pressure should be maintained below 180/105 mm Hg. The patient should be admitted to an intensive care unit or specialized stroke unit for close neurologic monitoring and blood-pressure control if needed.

Figure 2 (facing page). Stepwise Algorithm for Initial Management of Acute Ischemic Stroke in Adults.

All inclusion and exclusion criteria for the specific therapeutic indication should be verified before treatment is instituted. By convention, the time of stroke onset is established as the time that the patient was last known to be well (i.e., in a normal or baseline state, as confirmed by medical history). CT denotes computed tomography, CTA computed tomography angiography, DAWN Clinical Mismatch in the Triage of Wake Up and Late Presenting Strokes Undergoing Neurointervention with Trevo, DEFUSE Diffusion and Perfusion Imaging Evaluation for Understanding Stroke Evolution, ICH intracerebral hemorrhage, IV intravenous, MRA magnetic resonance angiography, and NIHSS National Institutes of Health Stroke Scale.





No potential conflict of interest relevant to this article was reported. Disclosure forms provided by the author are available with the full text of this article at NEJM.org.

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How to Calculate the Cost of Your Ad

We define a word as one or more letters bound by spaces. Following are some typical examples:

- Bradley S. Smith III, MD..... = 5 words
- Send CV = 2 words
- December 10, 2007 = 3 words
- 617-555-1234 = 1 word
- Obstetrician/Gynecologist ... = 1 word
- A = 1 word
- Dalton, MD 01622 = 3 words

As a further example, here is a typical ad and how the pricing for each insertion is calculated:

MEDICAL DIRECTOR — A dynamic, growth-oriented home health care company is looking for a full-time Medical Director in greater New York. Ideal candidate should be board certified in internal medicine with subspecialties in oncology or gastroenterology. Willing to visit patients at home. Good verbal and written skills required. Attractive salary and benefits. Send CV to: Reply Box 0000, NEJM.

This advertisement is 58 words. At \$9.80 per word, it equals \$568.40. Because a reply box was requested, there is an additional charge of \$75.00 for each insertion. The price is then

\$643.40 for each insertion of the ad. This ad would be placed under the Chiefs/Directors/Department Heads classification.

How to Respond to NEJM Box Numbers

When a reply box number is indicated in an ad, responses should be sent to the indicated box number at the address under "Contact Information."

Classified Ads Online

Advertisers may choose to have their classified line and display advertisements placed on NEJM CareerCenter for a fee. The web fee for line ads is \$115.00 per issue per advertisement and \$190.00 per issue per advertisement for display ads. The ads will run online two weeks prior to their appearance in print and one week after. For online-only recruitment advertising, please visit nejmcareercenter.org for more information, or call 1-800-635-6991.

Policy on Recruitment Ads

All advertisements for employment must be non-discriminatory and comply with all applicable laws and regulations. Ads that discriminate against applicants based on sex, age, race, religion, marital status or physical handicap will not be accepted. Although the *New England Journal of Medicine* believes the classified advertisements published within these pages to be from reputable sources, NEJM does not investigate the offers made and assumes no responsibility concerning them. NEJM strives for complete accuracy when entering classified advertisements; however, NEJM cannot accept responsibility for typographical errors should they occur.

NEJM is unable to forward product and service solicitations directed to our advertisers through our reply box service.

WE'RE A BEACON OF NEW THINKING IN INTEGRATED MEDICINE.

North Shore Physicians Group, the largest multi-specialty physician group north of Boston, is a leader in innovative practices. We are explorers at heart. We are physicians who continually seek the best ways to streamline care—for both patients and providers. Our medical team of more than 400 physicians, nurse practitioners, physician assistants and other care professionals is consistently working together to discover new ways to improve and enhance our practices to benefit the health of our patients and the careers of our providers. Through our team-based approach to medicine, we're making the practice of medicine smarter, less stressful and more efficient. Here ideas come from everyone—to the benefit of every patient.

JOIN OUR TEAM OF EXPLORERS WHO ARE BRINGING THE NEXT EVOLUTION OF QUALITY CARE TO THE COMMUNITIES NORTH OF BOSTON.



A BETTER PRACTICE DESIGNED FOR PHYSICIANS, BY PHYSICIANS.

Through continued input from our teams, we have built a culture that embodies the journey of evolution. We see processes differently because we learn from one another and continuously seek to change the way we practice medicine. With our collective knowledge, we have successfully implemented team-based care models that are revolutionizing our practice and leading to improved outcomes, including:

Provider Satisfaction: Our physicians are polling in the top 75th percentile of AMGA Satisfaction metrics for almost every major category—the highest physician satisfaction scores of any medical group in the Boston region.

Organizational Efficiency: 25th percentile in MGMA cost benchmarks and top 75th percentile in revenue benchmarks.

Patient Satisfaction: NSPG's MHQP Patient Experience surveys show that we perform higher than the state mean in all domains with 92% of patients indicating that they would recommend NSPG services.

And as a member of Mass General Brigham health care system and as an affiliate of Mass General Brigham Salem Hospital, we have a robust practice that includes teaching opportunities, EMRs, telehealth, online patient access and remote patient monitoring.

NORTH SHORE PHYSICIANS GROUP'S LYNN PRACTICE IS THE NEXT STEP ON A PROVEN PATH TO EXCELLENCE.

In August 2020, North Shore Physicians Group continued its expansion with the opening of a new practice at Mass General Brigham Health Care Center in Lynn, Massachusetts. This state-of-the-art 41,000-square-foot center was designed with input from our physicians, staff and patients and will benefit from our ability to:

- Level the patient volume for our providers and empower the entire care team to maximize their ability to provide high-value patient care tailored to their individual roles.
- Improve operations with remodeled facility designs to enhance the patient flow, synchronize care team schedules, optimize team communications with strategically placed workflow stations, and maximize exam room utilization.
- Co-locate primary and specialty care.
- Enhance patient and provider satisfaction.
- Minimize the need for after-hours work for physicians.

WE'RE A BEACON OF NEW THINKING IN INTEGRATED MEDICINE. JOIN US.

To apply or learn more about our opportunities, email your CV and letter of interest to **Michele Gorham** at mgorham@partners.org.



NORTH SHORE
Physicians Group

WWW.JOINNSPG.ORG

Classified Ad Deadlines

Issue	Closing Date
October 8	September 18
October 15	September 25
October 22	October 2
October 29	October 8

Addiction Medicine

ADDICTION MEDICINE — Positions available in one-year ACGME-accredited fellowships graduating clinical experts, faculty, and change agents to meet one of America's greatest health needs. Find fellowships at American College of Academic Addiction Medicine. www.acaam.org

Cardiology

EKG-101 — Learn Fundamentals of EKG Analysis on YouTube by Dr. Keivan Edalat (EKG-Certified by the American College of Cardiology), and it's all free. Simply go to: <https://m.youtube.com/watch?v=wEDNXb3BMTY>

Endocrinology

ENDOCRINOLOGIST, TIDEWATER (NORFOLK-VIRGINIA BEACH) VIRGINIA AREA — To join independent endocrine group. Thyroid ultrasound, FNA, bone density, clinical research. Competitive salary. Excellent benefits. Submit CV to Practice Manager, at: dcollins227@verizon.net

Hospitalist

HOSPITALIST (MULTIPLE POSITIONS) NEW ENGLAND INPATIENT SPECIALIST — (Multiple positions for day and night shifts are required at: Lowell, MA; Winchester, MA; Newburyport, MA.) Under the supervision of the Medical Director, the Hospitalist will: provide coverage to an acute care hospital; examine, diagnose, and treat patients; prescribe medication, and utilize medical equipment as needed. Minimum Requirements: MD or foreign equivalent, Eligible for Massachusetts Medical Licensure, and BC/BE in Internal Medicine. To apply, please send a CV and cover letter to: jhanson@neisp.com with reference to job code JO20.

GUTHRIE MEDICAL GROUP PC SEEKS HOSPITALISTS FOR POSITIONS IN SAYRE, PA — May be assigned rotations at non-primary location in Troy, PA, Towanda, PA, Corning, NY, or Cortland, NY. Requires professional medical degree, ACGME-accredited residency in internal medicine, board certified or active candidate in internal medicine, license to practice medicine in PA and NY. Send resume to: Shannon Anderson, Guthrie Medical Group, PC, 1 Guthrie Square, Sayre, PA 18840.

PHYSICIAN RECRUITER

The physician you're seeking is one of our readers. Advertise in the next issue of the *New England Journal of Medicine* and reach physicians in all specialties nationwide. For more information, contact Classified Advertising Sales at (800) 635-6991.

Infectious Disease

EXCELLENT OPPORTUNITY IN ATLANTA SUBURB FOR BC/BE PHYSICIAN — To join a unique, well-established, nine-doctor, four-location ID Practice with ACHC Accredited Office Infusion Center including a state-of-the-art clean room with staff pharmacist, as well as comprehensive wound care provided by CWCNs. Please e-mail CV to: atlanta.docs@gmail.com

BC/BE INFECTIOUS DISEASE PHYSICIAN — Triple O Medical Services, PA, is seeking a BC/BE Infectious disease physician. Must have MD or equivalent and completion of residency in Internal Medicine and fellowship in Infectious Diseases. Possesses or eligible for Florida medical license. Locations: West Palm Beach (Palm Beach County), Florida. If interested, e-mail resume to: drtripleo@tripleomedical.com

Nephrology

NEPHROLOGY ASSOCIATE NEEDED — Growing practice in University town with Residency program in NE Georgia looking to add associate. Competitive salary and benefits, call 1 in 4. J-1 or H-1 can apply. E-mail resume at: ngncmd@gmail.com

NEPHROLOGYUSA REPRESENTS NEPHROLOGY OPPORTUNITIES NATIONWIDE WITH GROUP PRACTICES — Excellent compensation, benefits with partnership, and joint venture potential. For additional information, call Martin Osinski at NephrologyUSA: 305-271-9225. E-mail: mo@nephrologyusa.com; website: www.NephrologyUSA.com

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Our experienced recruiters guide you every step of the way. Let them help you find practice opportunities that match your life and career needs.

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PSYCHIATRISTS

\$266,844 - \$320,640
annual salary (Board Certified)

\$260,004 - \$311,592
annual salary (Board Eligible)

INPATIENT • OUTPATIENT

FIND YOUR CAREER BALANCE IN CALIFORNIA

California Correctional Health Care Services is seeking proactive, knowledgeable psychiatrists to join our multidisciplinary teams. Within the California Department of Corrections and Rehabilitation's facilities, you will find like-minded professionals well-versed in the intricate psychiatric and medical interplay necessary to treat our diverse patient population. Here, you will see and develop treatment plans for cases you won't encounter in any other practice. And with the support of our dedicated medical assistants, you'll be able to devote your time to practicing and honing advanced psychopharmacological skills. Plus, with locations throughout California, you're sure to find your perfect fit.

In return for your efforts, we offer:

- 40-hour workweek with flexible schedules, including 4/10s
- Generous paid time off and holiday schedule
- 401(k) and 457 plans (tax defer up to \$39,000 - \$52,000 per year)
- State of California retirement that vests in five years (visit www.CalPERS.ca.gov for retirement formulas)
- \$10,000 Thank You Bonus to professionals newly hired with the State of California
- Relocation assistance available to professionals newly hired with the State of California
- Paid insurance, license, and DEA renewal
- Visa sponsorship opportunities

Take the first step in joining one of our teams and contact **LaTreee Phillips** at (916) 691-4818 or CentralizedHiringUnit@cdcr.ca.gov. You may also apply online at www.cchcs.ca.gov.

Effective July 1, 2020, in response to the economic crisis caused by the COVID-19 pandemic, the Personal Leave Program 2020 (PLP 2020) was implemented. PLP 2020 requires that each full-time employee receive a 9.23 percent reduction in pay in exchange for 16 hours PLP 2020 leave credits monthly through June 2022.

EOE

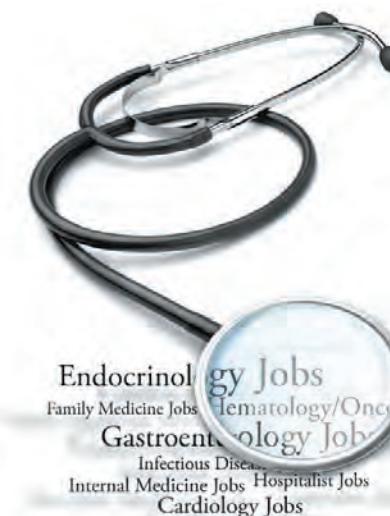
SEARCH AND APPLY FOR JOBS FROM YOUR PHONE.

NEJM CareerCenter, the physician jobs companion website of the *New England Journal of Medicine*, has a **NEW** iPhone app. Access our nationwide database to find quality jobs from a source you can trust.

- Search or browse quality physician jobs by specialty and/or location
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NEJMCareerCenter.org

NEJM CareerCenter



The NEW ENGLAND JOURNAL of MEDICINE

WHAT KIND OF DOCTOR WORKS IN CORRECTIONS?

DOCTORS JUST LIKE YOU.

By now, doctors know California Correctional Health Care Services offers more than just great pay and State of California benefits. Whatever your professional interest, we can help you continue to hone your skills in public health, disease management and education, addiction medicine, and so much more. All without the burdens of battling insurance companies or unrealistic RVUs.

PHYSICIANS IM/FP
\$282,216 - \$296,328
(Time-Limited Board Certified)

***PHYSICIANS IM/FP**
\$324,540 - \$340,776
(Time-Limited Board Certified)

PHYSICIANS IM/FP
\$268,080 - \$281,496
(Lifetime Board Certified)

***PHYSICIANS IM/FP**
\$308,292 - \$323,712
(Lifetime Board Certified)

PHYSICIANS IM/FP
\$253,992 - \$266,700
(Pre-Board Certified)

***PHYSICIANS IM/FP**
\$292,080 - \$306,696
(Pre-Board Certified)



Join Doctors Just Like You In One of the Following Locations:

We Also Offer a Competitive Compensation Package, Including:

- California State Prison, Corcoran - Corcoran*
- Centinela State Prison - Imperial
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- Kern Valley State Prison - Delano*
- North Kern State Prison - Delano*
- Salinas Valley State Prison - Soledad*
- 40-hour workweek
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- Relocation assistance for those new to State of California service
- Robust 401(k) and 457 retirement plans (tax defer up to \$39,000 - \$52,000 per year)

**Doctors at these institutions receive additional 15% pay.*

For more information, contact **Danny Richardson**
(916) 691-3155, CentralizedHiringUnit@cdcr.ca.gov
or www.cchcs.ca.gov



Effective July 1, 2020, in response to the economic crisis caused by the COVID-19 pandemic, the Personal Leave Program 2020 (PLP 2020) was implemented. PLP 2020 requires that each full-time employee receive a 9.23 percent reduction in pay in exchange for 16 hours PLP 2020 leave credits monthly through June 2022.



Join the largest faculty practice organization in the Northeast

ColumbiaDoctors at NewYork-Presbyterian is hiring Academic General Internists as part of our primary care expansion in Manhattan and Westchester County in New York.

- 1,800 elite healthcare providers
- Access to groundbreaking research and cutting-edge technology
- Columbia University academic affiliation
- Part of New York's #1 hospital system

Interested candidates should forward CV to: Delia Saraceno, Physician Recruiter, NewYork - Presbyterian, Des9819@nyp.org



Tenet Physician Careers

**A National Network.
A World of Opportunity.**

From newly trained residents and fellows to experienced practicing physicians looking to make a change, we offer a wide range of career opportunities in attractive locations. Our communities need physicians in a broad range of specialties. Whether you are interested in employment, relocating your practice or joining the staff of one of our urgent care centers, we most likely have an opportunity that's right for you.

Contact: Jeanie Harris

Jeanie.Harris@tenethealth.com

469-893-2639



Unleashing the potential in each of us drives performance for all of us.



Bring your ideas, compassion and commitment to a team that can bring them to a whole new level.

At OptumCare, we put the physician at the center and reward them for spending more time with each patient. We're at the forefront of value-based care and are building our physician-led, evidence-based practice model by mentoring our new physicians and giving them all of the support and resources they need to keep patients healthy.

Your ideas and thought leadership will be welcome as we continue to build local care delivery systems including primary care-based medical groups, independent physician associations, specialists and ambulatory surgery and urgent care centers.

At Optum, the fastest-growing part of the UnitedHealth Group family of companies, we are constantly looking for ways to improve lives and drive performance in the health care system. Join us and start doing **your life's best work.SM**



Explore opportunities across specialties nationwide: optum.co/nejm

OptumCare is committed to creating an environment where physicians focus on what they do best: care for their patients. To do so, OptumCare provides administrative and business support services to both its owned and affiliated medical practices which are part of OptumCare. Each medical practice part and their physician employees have complete authority with regards to all medical decision-making and patient care. OptumCare's support services do not interfere with or control the practice of medicine provided by the medical practices of any of their physicians. Diversity creates a healthier atmosphere: OptumCare and its affiliated medical practices are Equal Employment Opportunity/Affirmative Action employers and drug-free workplaces. Candidates are required to pass a drug test before beginning employment. © 2020 OptumCare. All rights reserved.

UNITEDHEALTH GROUP®



Cambridge Health Alliance (CHA) is an award-winning health system based in Cambridge, Somerville, and Boston's metro-north communities. We provide innovative primary, specialty, and emergency care to our diverse patient population throughout an established network of outpatient clinics and two full service hospitals. As a Harvard Medical School and Tufts University School of Medicine affiliate, we offer ample teaching opportunities with medical students and residents. We utilize fully integrated EMR and offer competitive compensation packages and comprehensive benefits for our employees and their families. Ideal Candidates will have a strong commitment to providing high quality care to our multicultural community of underinsured patients.

We are currently recruiting for the following departments and positions:

- ◆ **Psychiatry**
 - Adult - Inpatient & Outpatient
 - Primary Care Behavioral Health Integration
 - Child/Adolescent - Inpatient & Outpatient
 - Child - Primary Care Integration
 - Geriatric Psychiatry
- ◆ **Psychology**
 - Chief of Psychology
 - Child/Adolescent Outpatient
 - Primary Care Integration
 - Adult Outpatient
- ◆ **Primary Care**
 - Regional Medical Director
 - Internal Medicine
 - Family Medicine
 - Med/Peds
 - Float
- ◆ **Core Faculty Family Medicine**
 - Program Director
 - Tufts Family Medicine Residency
 - Director of Health Equity
 - Tufts Family Medicine Residency
- ◆ **Chief Medical Officer**
- ◆ **Department Chief, Surgery**
- ◆ **Otolaryngologist**
- ◆ **Pathologist**
- ◆ **Medical Director, Pain Management Program**
- ◆ **Obstetrics/Gynecology**
- ◆ **Vascular Surgeon**
- ◆ **Breast Surgeon**
- ◆ **Hospitalist/Nocturnist**
- ◆ **Sleep Medicine**
- ◆ **Pulmonary/Critical Care**
- ◆ **Gastroenterologist**
- ◆ **Physician Assistant**
 - Primary Care
 - Co-Chief, Primary Care
 - Gastroenterology

To apply please visit www.CHAProviders.org. Candidates may submit CV confidentially via email to ProviderRecruitment@challiance.org.
CHA Provider Recruitment – Tel: 617-665-3555/Fax: 617-665-3553

We are an equal opportunity employer and all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability status, protected veteran status, or any other characteristic protected by law.

HEROES CARING FOR HEROES

As a physician with the Defense Health Agency you ensure that those who serve our country get the quality care they need and deserve. That's why you became a doctor: to care for people and have a rewarding career.

If you're ready for a job that gives you the work-life balance you need with all the benefits you deserve, then discover the opportunities waiting for you at the Defense Health Agency.

• Competitive Salary	• Job Security
• Generous Paid Time Off	• Supportive Work Environment
• Recruitment Bonuses	• Worldwide Locations
• Flexible Schedules	

DHA employees are NOT subject to military requirements such as "boot camps", enlistments, or deployments.
 Department of Defense is an equal opportunity employer.

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CIVILIANMEDICALJOBS.COM



Breast Medical Oncologist

Fox Chase Cancer Center is an NCI-designated Comprehensive Cancer Center affiliated with Temple University Health System, features a unique collegial, interactive scientific environment that fosters collaboration between clinicians and scientists. Our multi-faceted research programs are closely linked to our multi-disciplinary clinical practice and our career opportunities are second to none.

Due to continued clinical growth, the Department of Hematology/Oncology at Fox Chase Cancer Center, located in Philadelphia, Pennsylvania, is seeking applicants for a full time Academic Breast Medical Oncologist. The candidate should have experience and strong clinical skills in Breast Oncology including disease management as well as clinical trial experience. Our goal is to identify a skilled clinician at the Assistant/Associate/ Professor level who has demonstrated commitment to clinical care in the in-patient and out-patient settings as part of the multi-disciplinary breast program. The successful candidate will also engage in clinical trials, teaching fellows and other learners as well as mentoring junior faculty. Faculty appointment at the level of Assistant Professor, Associate Professor or Professor is available depending on qualifications.

Candidates should be Board Certified or Eligible in Hematology or Oncology, and have an MD or equivalent degree.

This position includes a competitive start-up package, benefits and ongoing operational support. To learn more about Fox Chase Cancer Center, please visit:

www.fccc.edu

Review of applications will begin immediately and will continue until the position is filled. Interested individuals should send via email a cover letter, including a brief summary of research experience and interests, full contact information for three references and curriculum vitae to:

Martin Edelman, MD
 Chair, Department of Hematology/Oncology
 Fox Chase Cancer Center
 333 Cottman Avenue
 Philadelphia, PA 19111-2497
 Email: Martin.Edelman@fccc.edu

PHYSICIAN CAREERS AT The US Oncology Network

The US Oncology Network brings the expertise of nearly 1,000 oncologists to fight for approximately 750,000 cancer patients each year. Delivering cutting-edge technology and advanced, evidence-based care to communities across the nation, we believe that together is a better way to fight. usonology.com.

To learn more about physician jobs, email physicianrecruiting@usonology.com



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Primary care physicians at SSM Health in Wisconsin are the hearts and hands of our healing ministry. Our leadership is committed to providing physicians with the tools and resources they need to allow their expertise, compassion and wealth of talent to flourish. We empower our physicians to do what is best for their patients, seek new innovations in care, introduce new technologies and build or expand programs and services. By working together, we are redefining exceptional care and revealing the healing presence of God.

Visit JoinSSMHealth.com to find the right opportunity for you.



We are proud to be an Equal Opportunity Employer. Qualified applicants are considered for employment without regard to race, color, religion, sex, national origin, age, disability, veteran status, sexual orientation, gender identity or any other characteristic protected by law.



**Chief — Breast Cancer Program
— Medical Oncologist —**

Fox Chase Cancer Center is seeking a Disease Chief for the Breast Oncology Program. Fox Chase is a top-tier NCI-designated Comprehensive Cancer Center with a mandate to deliver excellence in oncology research and care. Fox Chase is seeking a dynamic, collaborative academic leader who will spearhead efforts to grow and expand the cutting-edge therapeutic, clinical research, and translational research program underway in Breast Oncology.

The Chief of the Breast Oncology Program will serve as a leader within the institution and will report directly to the Deputy Director for Clinical Research and Chair of the Department of Medical Oncology. The Disease Chief will play a critical role in shaping the direction of the Breast Oncology Program at Fox Chase. This will include having oversight of Breast Oncology services at all inpatient and outpatient facilities within TUHS, as well as several exciting opportunities including:

- ◆ Guiding the program in clinical and translational research
- ◆ Growing the Breast oncology program through the active recruitment of new faculty members and new community locations.
- ◆ Expanding Breast Cancer focused clinical research

Fox Chase Cancer Center Breast Oncology program currently sees 500 new patients with 4,500 follow ups annually in medical oncology; 1,665 patients receive radiation with 580 surgical procedures annually. The center is also renowned for its robust clinical research infrastructure and output. Its Nursing program has received the Magnet status of excellence, a record four consecutive times.

Fox Chase Cancer Center is located in Philadelphia, the 5th largest city in the United States, which boasts a diverse and exciting range of cultural and sporting activities and venues; the historical center of Independence Mall, the world-famous Barnes Foundation and Philadelphia Museum of Art, the Philly Pops, the largest standalone pops orchestra in the U.S.

Candidates should be Board Certified or Eligible in Hematology or Oncology, and have an MD or equivalent degree.

This position includes a competitive start-up package, benefits and ongoing operational support. To learn more about Fox Chase Cancer Center, please visit: www.fccc.edu

Review of applications will begin immediately and will continue until the position is filled. Interested individuals should send via email a cover letter, including a brief summary of research experience and interests, full contact information for three references and curriculum vitae to:

**Martin Edelman, MD, Chair, Department of Hematology/Oncology
Fox Chase Cancer Center
333 Cottman Avenue, Philadelphia, PA 19111-2497
Email: Martin.Edelman@fccc.edu**



PRIMARY CARE PHYSICIAN WANTED!!

Northeastern Vermont Regional Hospital is proud to offer you the chance to enhance your passion and live your dreams in an encouraging & supportive environment!

We are currently recruiting **PRIMARY CARE PHYSICIANS** in **Family Medicine** to join our hospital-owned group. New grads are welcome and encouraged to apply. **NO nights or weekends!**

Excellent specialty support - Urology, Women's Health, Neurology, Cardiology, Orthopaedics just to name a few!

NVRH offers a competitive salary and a generous benefits package including student loan reimbursement, 401K, relocation reimbursement, CME, medical/dental/vision, membership to local gyms, and more!

**Please contact Heather Spinney:
802-748-7312
h.spinney@nvrh.org
for further information**

***Also recruiting for other positions – please visit our website at www.nvrh.org**



Health Economist

**Center for Innovations in Quality, Effectiveness and Safety (IQES)
Michael E. DeBakey VA Medical Center and Baylor College of Medicine, Houston, TX**

IQES (a collaborative center of health services research between the Michael E. DeBakey VA Medical Center and Baylor College of Medicine) is seeking a **Health Economist Researcher** to join a grant-supported, multidisciplinary research team that is nationally recognized for work in patient safety, behavioral health, quality improvement, implementation science and population health.

Salary will be dependent upon qualifications.

Visit our website: <http://www.houston.hsr.resr.chva.gov>

Tasks and Responsibilities

- Develop program objectives, strategies and study methods on health care
- Design and execute research studies to guide effective use of information and resources
- Lead and direct plans to calculate various costs related to health care
- Utilize research programs on health economic topics
- Suggest new health outcomes for treatment and prevention of health issues
- Evaluate current and proposed strategies and interpret findings
- Communicate economic assessment results to appropriate internal audiences
- Perform economic analysis and model plans for health-care programs
- Communicate and distribute academic literature, presentations and reports on research findings to update about new issues, solutions and other topics
- Provide lectures or educational sessions to educate about health economics

Education Required

A health economist should possess minimum qualifications in order to qualify for such a position. PhD required in health economics, health policy, or the related branch of study with two years of work experience.

Skills Required

- Knowledge of the health-care industry and U.S. health system
- Good understanding of the subject of economics and international relations
- Right balance of mathematical and analytical aptitude to comprehend the economic aspects thoroughly
- Excellent research skills and ability to analyze findings to make appropriate use
- Clear understanding of the country's health economy
- Abreast with the national economic policies and its impact on the health-care sector
- Understand and apply mathematical concepts
- Fluent verbal and written communication skills
- Possess strong leadership and management skills
- Ability to work on multiple projects and meet deadlines
- Strong orientation to team work
- Experience in successful implementation of plans and achievement of objectives
- Ability to think analytically and strategically

Additional Qualification

- Applicants must be a **United States Citizen**
- Ability to work effectively as a member of an interdisciplinary team
- Excellent interpersonal and communications skills in both written and spoken English

Interested candidates should submit a current curriculum vitae and cover letter to:

**Ms. Shannon Kenyon, Chief of Operations, IQES 2450 Holcombe Blvd, Suite 01Y Houston, TX 77021
shannon.kenyon@bcm.edu**

Please reference "Health Economist" in subject line.



**Sean N. Parker Center
for Allergy & Asthma Research**

Allergy/Immunology Physician for Clinical Research Trials at the Sean N. Parker Center for Allergy and Asthma Research at Stanford University

The Division of Pulmonary, Allergy, and Critical Care Medicine and the Sean N. Parker Center for Allergy and Asthma Research at Stanford University in the Department of Medicine is recruiting outstanding Allergy and Immunology specialists to join our team in the Clinician Educator Line. This is an opportunity to join leading physician-researchers in an academic medical setting that focuses on excellence of care, research, and academic growth.

As a member of this growing team you will have the opportunity to lead innovative and cutting-edge research. We expect the successful candidate to have comprehensive skills in clinical research studies, as well as an interest in taking an active role in leading research teams on the national and global level. The ideal candidate must either be Pediatric or Internal Medicine trained and be Board Eligible/Board Certified in Allergy/Immunology and must possess a California medical license at the time of the appointment.

Our team of experienced clinical researchers in the Sean N. Parker Center are located at Stanford Hospitals (Palo Alto, CA) and El Camino Hospital (Mountain View, CA). We are looking for candidates interested in any/all these sites. We also may consider the right candidate for a role as the lead principal investigator of multinational clinical trials.

Stanford is an equal employment opportunity and affirmative action employer. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, disability, protected veteran status, or any other characteristic protected by law. Stanford welcomes applications from all who would bring additional dimensions to the University's research, teaching and clinical missions.

Interested applicants should submit a CV, a brief letter outlining interest and the names of at least three references to:

**Sharon Chinthrajah, MD
Director, Clinical Translational Research Unit
Sean N. Parker Center for Allergy and Asthma Research
Division of Pulmonary and Critical Care, Department of Medicine
Clinical Associate Professor, Stanford University
Angela Hy, Administrative Assistant
aahn2@stanford.edu**



**UNIVERSITY of MARYLAND
SCHOOL OF MEDICINE**

**Pulmonary & Critical Care Medicine Physician
(3-309-1045)**

The Division of Pulmonary and Critical Care Medicine at the University of Maryland School of Medicine seeks a full time pulmonary and critical care physician for our expanding critical care program. This position may cover our MICUs at the University of Maryland Medicine Center and the University of Maryland Midtown Campus locations, as well as participate in our inpatient and ambulatory Pulmonary practices. Opportunity exists for an administrative role in the intensive care unit for candidates with appropriate interest and experience.

Applicants must be BE/BC in Pulmonary and Critical Care medicine and have a strong interest in teaching and clinical research and be eligible to obtain an independent license to practice Medicine in the State of Maryland.

Expected faculty rank is Assistant Professor or higher, however, rank, tenure status and salary will be dependent upon selected candidate's qualifications and experience. We offer competitive salary and benefits.

When submitting your application, please provide a cover letter, current CV and brief statement summarizing clinical/research interests. You are also invited to include a perspective statement on equity, diversity, inclusion and civility.

Qualified applicants must apply online using the following link:

<https://umb.taleo.net/careersection/jobdetail.ftl?job=200000PU&lang=en>

Candidates can learn more from our division website:

<https://www.medschool.umaryland.edu/medicine/Divisions/Division-of-Pulmonary--Critical-Care-Medicine>

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Attention:

**Myrna Campbell
mecampbe@bidmc.harvard.edu
Administrative Supervisor**

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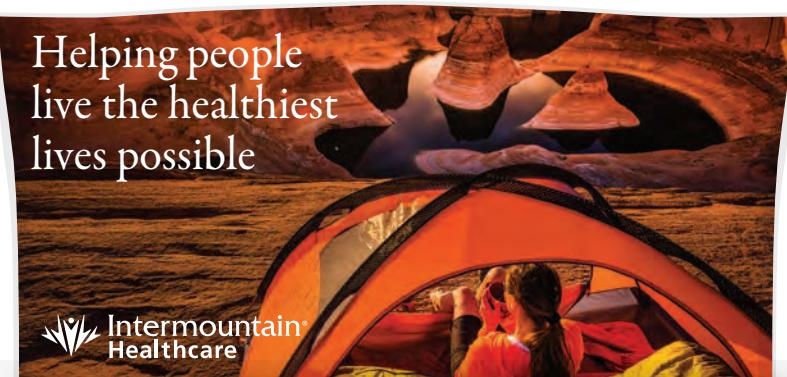
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Laura Schofield, 275 Grove Street, Suite 3-300, Newton, MA 02466-2275

E-mail: Laura_Schofield@atriushealth.org



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Submit CV, three letters of recommendation, including one from the Program Director or supervising physician, and personal statement to:

Dr. Deborah Hornacek
 Cleveland Clinic
 9500 Euclid Avenue (J3-5)
 Cleveland, OH 44195
 or contact Gerogann Yonkers (216) 444-6720
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The 130th Anniversary of Qilu Hospital of Shandong University

HEALING THE PEOPLE PURSUING THE TRUTH OF SCIENCE

Jinan, the capital city of Shandong province, has been nurtured by natural springs since ancient times. On this fertile land with a splendid history, Qilu Hospital of Shandong University (QLH) has achieved great accomplishments of glorious development, during which its vigorous and profound culture has been passed down from generation to generation. The spirit of healing the people and pursuing the truth of science germinated here and has remained unshaken ever since. For 130 years, QLH has stayed true to its original aspiration, and dedicated to curing the sick and rescuing the dying, fulfilling its commitment to medical ethics and professional excellence.

QLH is a hospital directly affiliated to Shandong University, a key national university under the direct jurisdiction of the Ministry of Education (MOE) and under the administration of the National Health Commission (NHC), China. Founded in 1890, the hospital was successively called Sino-American Hospital, Union Hospital, Cheeloo Hospital, and Affiliated Hospital of Shandong Medical University. In October 2000, it was renamed Qilu Hospital of Shandong

University. In recent years, taking Shandong province as the foothold, QLH has been aiming to become a high-level research-oriented hospital that is first-class in China and renowned in the world. Based in Jinan and Qingdao, the hospital has formed a development pattern of "three campuses in two cities" with a total of 5,000 beds and nearly 10,000 employees.

QLH is responsible for constructing one of the first regional medical centers built jointly by the NHC and provincial government at the national level. It also conducts the task of Intensive Care Medicine part in the national program of Improving Diagnosis and Treatment of Difficult and Complicated Diseases. Now QLH has 68 clinical and supportive departments, of which six (Emergency Medicine, Rehabilitation Medicine, Obstetrics and Gynecology, Neurosurgery, Haematology, and Clinical Laboratory) ranked among the top 10 in China's Medical Specialties Ranking 2019; nine others (Gastroenterology, Pathology, Otolaryngology, Endocrinology, Neurology, Cardiology, Geriatrics, Ultrasound Medicine, and Health Management) were nominated.

The Clinical Research Center of Shandong University built by QLH focuses on prevention, diagnosis, treatment, and prognosis of serious diseases. It facilitates the promotion of clinical disciplines through synergetic innovation in clinical research, incubation of key projects, and transformation of research achievements. The strengths of Shandong University as a comprehensive university are fully utilized to enhance interdisciplinary integration between medicine and other disciplines including engineering, science, social science and liberal arts. The planned 10,000m² clinical research center (on the International Medical Center campus) will be built into an ideal platform for clinical research transformation with Qilu Medicine's typical characteristics.

Since its beginning, QLH has been pursuing excellence and innovation by fully using the advantages of outstanding talents, significant technical impact in the region, and a strong brand effect at home and abroad. The hospital has continuously made contributions to the development of medicine in China as well as the health and welfare of the Chinese people.

130th ANNIVERSARY
QILU HOSPITAL

CARDIOLOGY

A GUARDIAN OF CARDIOVASCULAR HEALTH

Founded in 1959, the Department of Cardiology of Qilu (Cheeloo) Hospital is one of the earliest cardiovascular disciplines in China and serves as a comprehensive platform for clinical practice, teaching, research and training. This department consists of outpatient clinics, three inpatient wards, a critical care unit (CCU), an echocardiographic laboratory, an electrocardiographic laboratory, four cardiac catheterization laboratories, the Key Laboratory of Cardiovascular Remodeling and Function Research of the MOE and the NHC, and a branch department at Qingdao Campus. Subspecialties at the Department of Cardiology include coronary artery disease and atherosclerosis, cardiac arrhythmias, heart failure, structural heart disease, pulmonary vascular diseases, hypertension, critical cardiovascular diseases, cardiovascular imaging, and electrocardiography, which are led by nationally renowned experts and professionals and play a vital role in the diagnosis and treatment of critical and complex cardiovascular diseases in Shandong Province and east China. Department members pioneered exercise electrocardiography, stress echocardiography, Doppler echocardiography, multiplane

transesophageal echocardiography, and three-dimensional echocardiography in China. Moreover, this department was in the early rank to develop the following techniques in China: cardiac pacing and cardioversion, thrombolysis for acute myocardial infarction, percutaneous coronary intervention, percutaneous closure for atrial septal defect, ventricular septal defect and patent ductus arteriosus, and radiofrequency and cryoballoon ablation for tachyarrhythmias. The Department of Cardiology of Qilu (Cheeloo) Hospital has been conferred National Key Discipline by MOE, and National Key Clinical Specialty and Training Bases for Interventional Diagnosis and Treatment of Coronary Heart Disease, Congenital Heart Diseases and Arrhythmias by NHC. In addition, this department has been awarded the Innovative Research Group Fund by the National Natural Science Foundation of China.

The Department of Cardiology features research on the mechanisms, detection techniques and intervention strategies of cardiovascular remodeling. Under the leadership of Professor Yun Zhang, the department director and a member of the Chinese Academy of Engineer-

ing, the department has undertaken more than 250 national and provincial research projects and published more than 1,200 papers in high-impact international journals. In the field of basic research, this department was the first to establish a series of animal models of atherosclerotic vulnerable plaque, discovered multiple novel genes and mechanisms underlying the development and progression of vulnerable plaque and ventricular remodeling, developed new biomarkers and imaging techniques for detecting vulnerable plaque and ventricular remodeling, and revealed a series of new therapeutic targets for the early intervention of atherosclerosis and heart failure. In the field of clinical research, the department led the world-renowned EMINCA and CAPITAL studies, participated in over 30 international and national multi-center clinical trials, led or participated in the preparation of more than 20 Chinese and international clinical guidelines. Over the years, Department of Cardiology of Qilu (Cheeloo) Hospital has ranked number four to six in the Ranking of China's Hospital Science and Technology Influence issued by the Chinese Academy of Medical Sciences.

EMERGENCY MEDICINE

A FRONT-RUNNER IN CHINA'S EMERGENCY AND CRITICAL CARE MEDICINE

As one of the first emergency departments established in China, the Department of Emergency Medicine of Qilu Hospital has become a front-runner in emergency and critical care medicine in the country under the leadership of Professor Yuguo Chen, president of the ninth committee of Chinese Society of Emergency Medicine and president of Qilu Hospital. In 2019, it ranked third in China's Medical Specialties Ranking, and first in scientific research strength. Moreover, it is among the first in China to establish a complete disciplinary system incorporating several clinical subspecialties (emergency medicine, emergency surgery and poisoning) and research centers of basic medicine, translational medicine, clinical research and medical engineering. It has set an example for other Chinese hospitals to develop emergency and critical care medicine by forming a seamless treatment process including pre-hospital care, in-hospital emergency

care, ICU, emergency wards, and post-discharge follow-up. In 2002, it established the first Chest Pain Center in China, which has provided a green channel to save patients with acute chest pain by sticking to the principles of "early diagnosis, risk stratification, correct triage and scientific treatment". In the meantime, the department has been actively committed to applying the latest and advanced scientific achievements, as well as cutting-edge diagnosis and treatment concepts in clinical practice.

The department includes several units, such as pre-hospital and in-hospital care, outpatient service and inpatient ward, and scientific research, focusing on five key directions: acute chest pain (mainly acute cardiovascular diseases), cardiopulmonary cerebral resuscitation, critical illness, emergency trauma, and acute poisoning. It has taken the lead in making several guidelines, such as the *Expert Con-*

sensus on Emergency Diagnosis and Treatment of Acute Chest Pain and the Expert Consensus on Adult Extracorporeal Cardiopulmonary Resuscitation. It also initiated the Chinese Emergency Medicine Alliance, China Chest Pain Alliance, and China Cardiopulmonary Resuscitation Research Collaboration Network.

Over the years, the department has been doing clinical, basic, and translational research on chest pain—dominated acute and critical cardiovascular diseases, cardiac arrest and cardiopulmonary cerebral resuscitation, and organ function evaluation and protection. It first discovered that the acetaldehyde dehydrogenase 2 (ALDH2) rs671 mutation (with a carrying rate of 30% - 50% in Asian population) was positively correlated with the onset and prognosis of acute coronary syndrome (ACS) but negatively correlated with aortic aneurysm, revealing the underlying molecular mechanisms and

providing novel theories and targets for the prevention and treatment of acute and critical cardiovascular diseases. It has conducted cohort studies about precise risk assessment and prognostic prediction of ACS, and created a biomarker-based ischemia and bleeding risk assessment system targeting patients with acute cardiovascular diseases in China, informing health management and clinical decision-making with regard to acute cardiovascular diseases. Moreover, it has been leading the national epidemiological survey of cardiac arrest: the BASIC Registry, which is the first large-scale cardiac arrest registry system covering all provinces in China. A series of research results were published in *European Heart Journal*, *JAMA Cardiology*, and other academic journals.



REHABILITATION

CROSSING THE GULLY OF DYSFUNCTION LIGHTING UP LIFE OF THE DISABLED

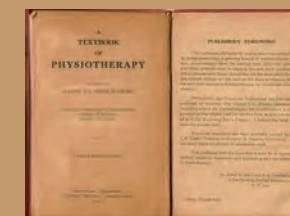
The Department of Physiotherapy of QLH was established in 1923. In 1935, V.L. Nunn, a physician of the department, wrote China's first monograph on physiotherapy. In 2000, after generations of efforts and exploration, the department was expanded into the comprehensive Rehabilitation Center. Its three-dimensional fast traction of lumbar spine, listed in multiple editions of several textbooks, is a world-leading technique integrating both Chinese and Western medical theo-

ries. The treatment parameters it put forward have been adopted by more than 1,000 hospitals. Furthermore, the center was the first in the world to report the therapy of balloon imaging combined with CT-guided botulinum toxin injection into the upper esophageal sphincter, benefiting patients with intractable dysphagia caused by cricopharyngeal achalasia. The department is dedicated to the rehabilitation of the injured, sick and disabled with system dysfunctions, helping them restore

quality of life. At present, it has distinctive sub-specialties such as neurological rehabilitation, orthopedic rehabilitation, spinal cord injury rehabilitation and pediatric rehabilitation.

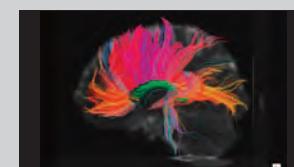
Professor Shouwei Yue, Director of the Rehabilitation Center, is now the chairman of the Chinese Society of Physical Medicine and Rehabilitation and vice chairman of the Chinese Association of Rehabilitation Medicine. The center drafted 20 clinical pathways for rehabilitation is-

sued by the NHC, edited three planned textbooks, oversaw the *Chinese Guide to Rehabilitation of Low Back Pain* compilation, and has undertaken 18 projects funded by the National Natural Science Foundation of China.



NEUROLOGY

THE CRADLE OF NEUROLOGICAL SCIENCES OF SHANDONG PROVINCE



Founded in 1958, the Department of Neurology at Qilu Hospital of Shandong University was the birthplace of neurology in the Shandong Province. It is also one of China's oldest teaching and research institutions in this field. The department was divided into the Department of Neurology and the Department of Neurosurgery in 1959.

The Department of Neurosurgery now ranks ninth nationwide in terms of comprehensive strength (China's Medical Specialties Ranking 2019). It provides diagnosis and treatment of all neurosurgical disorders across a wide range of sub-specialties, including brain tumors, intracranial and spinal

vascular diseases, functional neurosurgery, spinal and spinal cord surgery, mild and severe traumatic brain injuries, as well as pediatric neurosurgery. Tens of thousands of neuro-oncology surgeries have been performed since the establishment of the department, and to date it is among China's best neuro-oncology centers, in terms of quantity and quality. It is also one of the earliest institutes in the country to perform hybrid surgical procedures in patients with complicated cerebrovascular diseases, which significantly improve their survival rate and health-related quality of life. In addition, in 2008, the Department of Neurosurgery was one of the first in China to offer a standard neuroendoscopy training program, and more than 500 trainees across the country have completed the courses since then.

The Department of Neurology

has set up the neuropathology laboratory in 1985, conducting the diagnosis and molecular pathological analysis by biopsies from the brain, peripheral nerves, and muscles. The Department focuses on the precise diagnosis of neuroimmunology, neurodegeneration, genetic defects and dysmetabolism, and it investigates their molecular pathomechanisms. Renowned for one of the national key clinical specialties, the department has been leading nationally in fields such as epilepsy, Parkinson's disease and movement disorders, cerebrovascular diseases and rare neurological diseases.

The close collaborations of the Department of Neurology and the Department of Neurosurgery have been productive, enjoying a great reputation in China in cerebrovascular diseases, Parkinson's disease, and epilepsy. In 2015, the Qilu Brain

Project was launched. Since then, the departments have adapted a new pyramid-shaped research system, which defined five levels of brain research: interpretation, protection, simulation, manipulation, and reconstruction of brain function. Scientific breakthroughs have been made in understanding the molecular pathogenesis of glioblastoma and mechanisms underlying its progression. The findings are published in high-profile journals including *Brain*, *Autophagy*, *Neuro-Oncology*, and *Clinical Cancer Research*. Moreover, the departments also developed a computer-aided diagnosis system based on MRI for glioblastoma diagnosis and classification, as well as microfluidic chips with suited detection device for detecting glioblastoma-associated biomarkers in cerebral spinal fluid, both of which have already applied for patent from National Intellectual Property Administration.

OBSTETRICS AND GYNECOLOGY

THE GUARDIAN OF WOMEN'S HEALTH

The department was among the country's earliest to offer a doctoral program in obstetrics and gynecology. The discipline was listed in the second batch of national key disciplines and the first batch of national key clinical specialties. Ranked in China's top 10, the team played a key role in editing the national-planned textbook *Obstetrics and Gynecology*, and in sponsoring *Progress in Obstetrics and Gynecology*, one of China's core journals.

The team consists of 120 obstetricians and gynecologists who specialize in gynecological oncology, general gynecology, family planning, perinatal medicine and reproductive medicine, with gynecological oncology being a national key discipline. Clinically, these physicians treat about 1,500 female patients with malignant tumors in primary management every year — the five-year survival rate for ovarian cancer recently reached 50%— which is one of the highest in the world. They have developed the *Diagnosis Criteria for Cervical Cancer*, the national health standard, for the NHC, and have led the development of several guidelines and expert consensus documents for the diagnosis and treatment of gynecologic oncology. It also established the world's first ultra-fast approach to identifying cervical lesions.

The focal points of team members' research include the pathogenesis, early diagnosis, and comprehensive therapy of gynecological tumors. They have suggested several innovative theories, such as "low-grade serous ovarian carcinoma originating from oviducts", which is included in national-planned textbooks on obstetrics and gynecology as well as guidelines for the diagnosis and treatment of gynecological tumors. In the last decade, team members have undertaken more than 100 national-level research projects, leading to over 200 international publications and 30 national invention patents.

130th ANNIVERSARY
QILU HOSPITAL



HAEMATOLOGY

THE HUNTING OF PLATELET KILLER

Founded in 1959 by Maohong Zhang, a distinguished haematologist, the Department of Haematology at Qilu Hospital of Shandong University was ranked as top 10 nationally for seven consecutive years. It has a comprehensive system of subspecialties, including thrombosis and haemostasis, leukemia, erythrocyte diseases, lymphoma/myeloma, haematopoietic stem cell transplantation, and myelodysplastic syndrome. This department aims to become an internationally recognized, innovative medical center that integrates clinical care, scientific research, and intelligence training.

With a focus on primary immune thrombocytopenia (ITP) and acute myeloid leukemia, the Department of Haematology is currently Asia's largest and most renowned center for the research, diagnosis, and treatment of ITP. Professor Ming Hou has chaired the committee that drafted four editions of the Chinese ITP guidelines. The team has revealed the role of immune tolerance in the pathogenesis of ITP; developed a novel strategy, combining Rituximab with recombinant human Thrombopoietin (rhTPO) to treat corticosteroid-resistant/relapsed ITP; and conducted a clinical study to compare the effect of high doses of dexamethasone and prednisone in ITP patients, which has been the largest prospective clinical trial so far and has provided level I evidence for international guidelines. The team has also used rhTPO in pregnant ITP patients and has conducted clinical trials for refractory ITP by using low-dose decitabine. For the study of biological abnormality in leukemia, the Joint Laboratory of Intelligent Diagnosis and Treatment of Haematological Diseases, led by Professor Chunyan Ji, has developed an innovative system using genomics and big data analysis to predict primary drug-resistance molecular markers in acute myeloid leukemia.

130th ANNIVERSARY
QILU HOSPITAL



The Clinical Laboratory of Qilu Hospital is a pioneer in this field in China. Laboratory Diagnostics, the first textbook of its kind, was published in 1921 by Fuxin Yu, an expert who developed the world-renowned Yu's Ring Test for syphilis diagnosis in 1935. As a National Key Clinical Specialty, it acts as a regional provider of medical services and basic training, and it plays an important role in editing textbooks of laboratory medicine and materials for standardized residents training.

The Department of Clinical Laboratory has studied non-invasive tests for tumor markers and its clinical practices since the 1990s. In recent years, by leveraging China's first batch of platforms such as the "High-Throughput Sequencing Platform for Tumor Diagnosis and Treatment," the department has made advances in screening and identification of molecular targets associated with malignant tumor development and progression. It also developed a detection technique that has been trademarked, which has been translated into clinical practice. It developed a standardized protocol to directly quantify circulating RNAs, and first reported the role of exosomal long noncoding RNA (lncRNA) HOTTIP in the diagnosis and prognosis of gastric cancer. In addition, it developed a novel kit for detecting serum-based exosomal miRNAs or lncRNAs in colorectal cancer. The department will continue to strive for progress in cancer diagnosis.

CLINICAL LABORATORY

THE EXPLORER OF ONCOGENES

So far, the hospital is playing a leading role in building the first regional medical centers at national level, and is dedicated to becoming a first-class research-oriented hospital that represents the nation's top healthcare capacities, supports regional medical development, and meets people's healthcare needs. By advancing medical sciences in China and beyond, QLH will make its own contributions to build a shared community of common health for all mankind.

Call to Apply for the Director of the NHC Key Laboratory of Otorhinolaryngology of China

Established in 1989 by former Shandong Medical University, the NHC Key Laboratory of Otorhinolaryngology is currently managed by Qilu Hospital of Shandong University. The 3,000m² laboratory is equipped with the best facilities of the nation to support studies in molecular biology and molecular epidemiology. Based on its abundant clinical resources, the laboratory has established the largest biobank of head and neck tumors in Shandong Province, providing clinical cases for basic and clinical translational research of head and neck tumors.

The laboratory is now recruiting for a director. If you are interested, please email us at qlyyjsc@126.com or call +86-531-82169026.

GASTROENTEROLOGY

EXPLORING FRONTIERS AND SERVING PATIENTS

Rated as one of the first national key clinical specialties, the Department of Gastroenterology has been at the forefront of this branch of medicine. In the field of confocal endomicroscopy, the department has established the diagnostic criteria for gastric cancer and precancerous lesions, dubbed the Qilu Criteria, which is the only technical standard named by a Chinese institution that has been adopted by the global endoscopy community. The team maintains close collaborative research relationships with industry to use endoscopic tools in the diagnosis and treatment of early gastrointestinal cancers, and it works toward the development and application of artificial intelligence diagnostic tools and robots for minimally invasive endoscopic surgery. These efforts, supported by the National Key Research and Development Program, have made important achievements, some of which are widely applied in primary hospitals. It leads the country in performing enteroscopy in patients with inflammatory bowel disease (IBD). It has established the country's first Center for Micro-ecology Research, Diagnosis and Treatment at the provincial level, and it has been given the approval to build a national IBD center for the region. It has also shed light on the neuro-immune-endocrine network underlying the abnormal brain-gut interactions in irritable bowel syndrome. The research was funded by the National Natural Science Foundation of China and published in academic journals such as *Gut*.

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