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The value of the modern vascular surgeon to the health care system: A report from the Society for Vascular Surgery Valuation Work Group

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ABSTRACT

Vascular surgeons provide an important service to the health care system. They are capable of treating a wide range of disease processes that affect both the venous and arterial systems. Their presence broadens the complexity and diversity of services that a health care system can offer both in the outpatient setting and in the inpatient setting. Because of their ability to control hemorrhage, they are critical to a safe operating room environment. The vascular surgery service line has a positive impact on hospital margin through both the direct vascular profit and loss and the indirect result of assisting other surgical and medical services in providing care. The financial benefits of a vascular service line will hold true for a wide range of alternative payment models, such as bundled payments or capitation. To fully leverage a modern vascular surgeon's skill set, significant investment is required from the health care system that is, however, associated with substantial return on the investment. (J Vasc Surg 2021;73:359-71.)

Keywords: Vascular surgery; Practice; Finance; Safety

Vascular surgery is an integral part of a complex health care system. Because vascular surgery is a relatively small specialty, the role and importance of the vascular surgeon in the health care system may be underestimated. There is currently a shortage of vascular surgeons in most of the United States, and this shortage is expected to worsen through 2025. Currently, one-third of hospitals in the United States are recruiting a vascular surgeon. The purpose of this report is to serve as a reference document for hospital administration, vascular section chiefs, and vascular surgeons to describe the scope of the modern-day vascular surgery practice and the financial impact on the health care system. Particular emphasis is placed on the importance of vascular surgery as an enabling service line. A multitude of specialties require vascular surgery assistance to perform complex procedures safely. In addition, vascular surgery availability is critical to provide rapid intraoperative rescue of unintended hemorrhage or ischemia. These attributes of the vascular surgery practice are frequently invisible to hospital administration. Not only does a vascular surgery service line improve operating room (OR) safety, it has a profound impact on hospital margin that is frequently underappreciated. We also describe the impact of the vascular surgeon participating in a value-based care practice model and the role of the vascular surgeon in promoting quality and safety in vascular care. Last, the infrastructure needs to successfully recruit and to retain a vascular surgeon are discussed.

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Funding was provided through the Society for Vascular Surgery.

Author conflict of interest: none.

Additional material for this article may be found online at www.jvascsurg.org.

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Independent peer review and oversight have been provided by members of the SVS Document Oversight Committee (Drs Thomas L. Forbes, chair, Ruth Bush, vice-chair, Neal Barshes, Keith Calligaro, Yazan Duwayri, Alik Farber, Gregory Landry, Mahmoud Malas, Katherine McGinigle, J. Sheppard Mondy, Marc Schermerhorn, and Cynthia Shortell).

0741-5214

https://doi.org/10.1016/j.jvs.2020.05.056

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THE SCOPE OF PRACTICE OF THE MODERN VASCULAR SURGEON

The modern vascular surgeon provides both medical and procedure-based care to patients with vascular disease. Vascular surgeons are well versed in risk factor management as well as in both open and endovascular interventions. They often provide state-of-the-art wound care as well as long-term follow-up of patients with vascular disease. Vascular surgeons provide a unique mix of medical, open surgical, and endovascular skills and fulfill a vital role in the continuum of care of these patients. The primary disease process treated by vascular surgeons is atherosclerosis, which affects millions of Americans. Inflammatory arteriopathies, compression syndromes, traumatic vascular injuries, and venous thrombotic disease are also managed and treated by vascular surgeons.

Peripheral artery disease (PAD). Vascular surgeons focus on all aspects of the treatment of PAD, including medical, endovascular, and open surgical therapies. In the 21st century, PAD has become a global problem, and the number of individuals suffering with PAD has increased by 28.7% in low-income or middle-income countries and 13.1% in high-income countries.[1]

The major modifiable risk factors of PAD include smoking, diabetes mellitus, hypertension, and hyperlipidemia. Despite attempts to raise awareness of PAD as an important marker of increased cardiovascular risk, most patients remain inadequately treated before referral to a vascular clinic. Reports have shown that relatively few patients are receiving triple cardiovascular therapy (50%-70% antiplatelet, 44%-50% statins, 50%-54% antihypertensive drug). Vascular surgeons validate and optimize medical treatment of risk factors when they see new patients and are more likely to provide cross-continuum vascular care including preprocedural and postprocedural management of the vascular patient. Vascular surgeons are trained to perform both open and endovascular therapies and have a national registry (Vascular Quality Initiative) to validate optimal outcomes. *A particularly important niche of vascular surgeons is the ability to combine both open and endovascular therapy into hybrid procedures that can take advantage of the unique opportunities that endovascular and open surgery provide.*

Venous disease. Chronic venous disease affects >25 million adults in the United States, with >6 million having severe disease.[2] Vascular surgeons provide care for both deep and superficial venous disease. Both deep and superficial venous disease can be manifested as leg pain and swelling, varicose veins, venous stasis dermatitis, and venous stasis ulceration. In addition, women can suffer from pelvic congestion syndrome as a result of deep venous disease in the gonadal veins. Vascular surgeons have expertise in the treatment of both deep and superficial venous disease and endovascular ablation techniques as well as stenting and embolization techniques that are required for expert treatment of such disease states.

Aneurysmal disease. Thoracic and abdominal aortic, visceral, renal, and peripheral aneurysm repairs are standard procedures for the vascular surgeon. Many of these patients can be treated with endovascular techniques; however, some still require open surgery to be treated optimally, and vascular surgeons are the only specialists who can provide both options as well as make strategic decisions about which method most benefits the patient.

Carotid artery disease. Carotid atherosclerotic disease is responsible for approximately 41,000 strokes annually in the United States, and approximately 1% of all adults 65 years of age and older will have a clinically significant asymptomatic carotid stenosis of >60%.[3,4] Vascular surgeons are experts in the medical and procedural treatment of carotid artery disease. In addition to medical management of risk factors, several interventions may benefit the patient with carotid disease, including open endarterectomy (surgical removal of the plaque), transfemoral endovascular stenting, and transcarotid artery revascularization (TCAR). Vascular surgeons are the only specialists who can offer all of these alternatives. The decision to proceed with

intervention can be complex, especially for asymptomatic patients, and vascular surgeons are well suited to help patients make the optimal, evidence-based decision for one therapy over another without the potential bias inherent if the physician is limited in the scope of interventions he or she can provide. In addition, they provide surveillance both before and after the procedure to maintain the optimal timing for and durability of the intervention.

Hemodialysis access. According to the National Institute of Diabetes and Digestive and Kidney Diseases, there are currently 468,000 Americans undergoing dialysis. Vascular surgeons are the primary specialty involved in placing and maintaining dialysis access in this population of complex patients. This includes temporary catheter placement, arteriovenous fistula, arteriovenous graft placement, and the associated procedures to maintain patency and to treat associated complications. Maintaining adequate dialysis access is the cornerstone and Achilles heel of providing lifesaving renal replacement therapy to patients suffering from end-stage renal disease.

Thoracic outlet syndrome (TOS) and arterial compression syndromes. TOS encompasses three syndromes (neurogenic, venous, and arterial) that involve compression of the nerves, arteries, and veins as they traverse the thoracic outlet region at the base of the neck. These conditions frequently affect young, healthy, active individuals and can be severely debilitating. TOS is seen frequently in many types of professional athletes and otherwise young, healthy patients. Surgery involves decompression of the outlet with procedures such as first rib resection and scalenectomy. Vascular surgeons can offer appropriate treatment for all manifestations of TOS, especially surgical and endovascular repair of arterial and venous lesions.

Unusual pathologic processes that can affect young individuals, including arterial entrapment syndromes in the lower extremity and median arcuate ligament syndrome, are cared for by vascular surgeons.

Spine exposure. Patients with various spine diseases are increasingly being treated with anterior or oblique approaches to the spine. Vascular surgery presence is needed to provide safe exposure and to handle unexpected bleeding. Whereas these procedure provide relatively modest relative value unit (RVU) compensation, they are frequently one of the highest revenue-generating procedures for the health care system because of the technical revenue generated through the diagnosis-related group payment. This is discussed in greater detail later in this document. The ability to provide this service hinges on the presence of vascular surgeon support to provide this exposure safely.

Wound care. Vascular surgeons are experts in wound care, especially in patients with critical limb ischemia. They frequently are the de facto lower extremity wound care physicians and work closely with podiatry to provide appropriate wound care in both the inpatient and outpatient settings.

Vascular trauma. Vascular trauma can result in life-threatening hemorrhage or end-organ ischemia. Surgical repair can involve open repair of the injured vessel or incorporate endovascular techniques. A combination of open and endovascular skills is often needed to provide optimal care to these critically injured patients, and vascular surgeons are optimally trained to treat these injuries. These injuries arrive unexpectedly and require immediate attention from a vascular surgeon.

Intraoperative consultation. One of the most valuable services that vascular surgeons provide is intraoperative consultation to surgeons when complex operations involve major vascular structures. These consultations fall under two categories: planned and emergent.

Planned combined cases include a variety of situations, such as assisting the oncologic surgeon to perform a curative resection. The breadth of oncologic surgeons who require vascular assistance includes otolaryngologists, gynecologists, orthopedists, urologists, and surgical oncologists. In addition, both orthopedic and neurosurgical anterior spine exposures require elective vascular surgical assistance. This category also includes stand-by consultations, which occur at least as frequently as actual operative assists. Examples include standing by in case of need during oncologic procedures and availability to deal with complications during catheterization procedures, such as percutaneous aortic valve surgery or extracorporeal membrane oxygenation. Without the presence of a board-certified vascular surgeon on stand-by, some hospitals may decide it is not safe to offer certain interventions, such as complex oncologic, neurosurgical, or orthopedic operations, or be potentially susceptible to litigious complaints.

Emergent intraoperative consultation involves handling unexpected bleeding, arterial or venous injury, or blood vessel occlusion. Very often, the vascular surgeon is called emergently, when help is needed but was not anticipated. Consequently, in the delivery of surgical care in the modern hospital, the vascular surgeon plays a critical and essential role in maintaining a safe OR environment. The emergent nature of these consultations can be disruptive for the vascular surgeon's elective operating and clinic schedule and the patients affected by this disruption.

Noninvasive vascular laboratory. Initial diagnosis of vascular disease is by history and physical examination yet often requires further testing, such as duplex ultrasound scanning, computed tomography, and magnetic

resonance angiography. Conventional angiography involves invasive intervention with the additional risks of contrast nephrotoxicity and vessel complication. Because of rapid advances in probe technology and data software processing, duplex ultrasound scanning, which is less expensive and noninvasive, has eliminated the need for many angiographic procedures. The modern vascular laboratory is integral to the modern-day vascular surgical practice. All vascular beds can be assessed noninvasively. Vascular surgeons work closely with vascular technologists using these studies to diagnose the severity of vascular disease, to assess outcomes after intervention, and to monitor progression or recurrence of disease. Vascular surgeons are required to document expertise in noninvasive vascular laboratory testing through successful Registered Physician in Vascular Interpretation certification.

THE FINANCIAL VALUE OF THE VASCULAR SURGEON

The fiduciary advantage of a vascular surgeon in the health care system is difficult to measure and frequently underestimated. Besides the intrinsic value of the vascular surgical service line, vascular surgeons are an essential resource to other surgical specialties, providing exposure, control of hemorrhage, and vascular reconstructions, often in emergent situations. In addition to providing operative consultations, vascular surgeons provide support to other nonsurgical services. Following is a review of the literature and several case studies that attempt to define both direct and indirect fiduciary benefits of a vascular surgery service line.

The vascular surgery service line

Data regarding the entire book of business for a vascular surgery service line are difficult to acquire. Taylor et al[5] found that vascular surgeons on average produced $1.6 million per clinical full-time equivalent (FTE) based on 8423 work RVUs/FTE. This was the fourth highest revenue-producing section in the health care system. It is clear that the profit and loss based only on professional fees will result in a net negative margin. However, the much larger technical revenue generated by the vascular surgeon more than offsets the impact of poor professional reimbursement on the total contribution margin. In the study by Taylor et al,[5] whereas the average professional reimbursement was $33/RVU, the technical revenue was $191/RVU. In a similar study by Perri et al,[6] the professional revenue generated was $100/RVU compared with the technical revenue of $525/RVU. Fairman, in a more recent presentation from 2018,[7] reported a $9.2 to $11.6 million annual contribution margin from a medium-sized vascular surgery group at an academic medical center. This resulted in 1.7 million doallrs in contribution margin per clinical FTE.

Case study. This is a case study of a vascular surgery program at a 400-bed academic medical center in New England consisting of 4.8 clinical surgeon FTEs supported by three midlevel providers. The service line saw 8396 office visits, of which 939 were new patients. The noninvasive vascular laboratory was a component of the service line, generating 10,982 vascular studies. In addition, they performed 1291 OR procedures and 450 ambulatory angiographic procedures. This work generated 41,179 work RVUs (8555 RVUs/FTE) and required on average 2.8 hours ("skin to skin" time) per operative case. Net professional margin was −$1,325,831, and net technical margin was $5,580,961. Total contribution margin was $4,255,112 or $886,484 per clinical FTE. The average case mix index (CMI) for inpatients was 2.68; average length of stay was 4.78 days. This was based on a payer mix that consisted of 69% Medicare, 14% Medicaid, 15% commercial, and 2% other.

Value of vascular surgery assisting other specialties

In many institutions, the discharging service gets "credit" for the technical revenue generated from the diagnosis-related group payment. The magnitude of this payment is frequently fivefold higher than the corresponding professional payment based on *Current Procedural Terminology* codes. As previously discussed, vascular surgeons frequently play a vital role in the performance of many procedures that generate significant revenue for the hospital and that could not be performed without the presence of a vascular surgeon.[8-11] Elective procedures include anterior spine exposure, arterial reconstruction during tumor resection, and assistance with complex dissection around vascular structures. Just as important are the emergent procedures for control of unexpected hemorrhage and revascularization for iatrogenic ischemia. Yet vascular surgery is infrequently the discharging service and therefore may not receive credit for the technical revenue generated during these procedures. Data to quantify the revenue generated by vascular surgeons assisting other services are difficult to come by.

Johnson et al[8] evaluated hospital financial data for all inpatient operative cases during a 3-year period (2013-2015). Cases in which a vascular surgeon provided operative assistance as a consultant to a nonvascular surgeon were identified and designated planned or unplanned. A wide range of services required vascular surgery assistance (Fig). Contribution margin, defined as hospital revenue minus variable cost, was determined for each case. They identified 208 cases with a primary nonvascular surgeon who required a vascular co-surgeon. Of these 208 cases, 169 (81%) were planned and 39 (19%) were unplanned. The median hospital contribution margin for vascular surgery consultation cases was $14,406. The average CMI for cases involving vascular surgery was 5.4 (interquartile range, 4.1) compared with 2.1 (interquartile

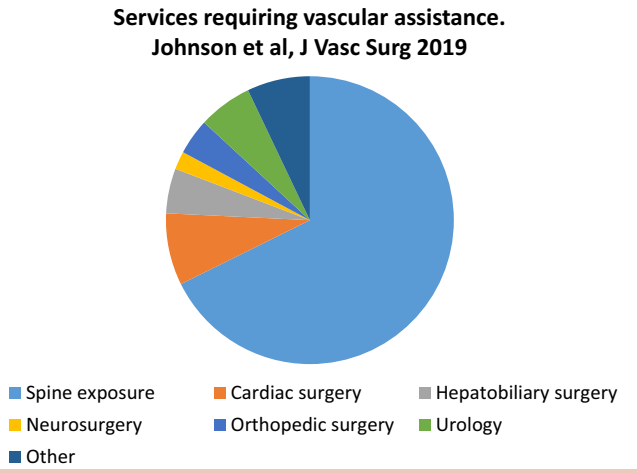

Fig. Services requiring vascular surgical assistance either electively or emergently.

range, 1.8) for cases not requiring vascular surgery ($P < .001$). These findings in aggregate demonstrate that the need for vascular surgery operative assistance occurs frequently and is associated with significant financial value, reflected by a high contribution margin.

Whereas emergent consultations to control hemorrhage and to perform arterial reconstructions are common, this can frequently disrupt the surgeon's elective daytime operative or clinic schedule. This can in turn lead to decreased satisfaction of patients expecting to see the vascular surgeon in the clinic or OR. Frequently, the vascular surgeon is not called until evening or night. The urgent-emergent nature of a modern vascular practice can make maintaining a stable daily schedule difficult and can have a negative impact on the surgeon's quality of life. These challenges faced by the hospital-based vascular surgeon are frequently not fully appreciated by hospital administration.

This is borne out by an analysis performed by Danczyk et al[12] at a tertiary hospital between 2006 and 2014. This group showed that vascular surgeons performed 225 intraoperative consultations in support of procedures by nonvascular surgeons. These consultations were unexpected and emergent in 81% of cases, and in 26% of cases, the request for assistance occurred after 6 PM. Requesting services were surgical oncology (46%), orthopedics (17%), urology (11%), otolaryngology (7%), and others (19%). The reason for consultation often included more than one of the following categories: vascular reconstruction (53%), control of hemorrhage (39%), and assistance with difficult dissections (43%).

Manzur et al[10] analyzed 76 vascular surgery intraoperative consultations performed at a single center (2013-1016). They found that 56% of these consultations were unplanned and requested urgently. An unplanned operative consultation was most commonly requested for bleeding (33%), whereas a planned consultation was most commonly requested for a vascular reconstruction (43%). The consulting services by specialty included cardiac surgery (24%), urology (18%), orthopedics (17%), hepatobiliary/transplantation (16%), and other (25%).

Case study. In a case study examining the impact of off-service vascular surgery revenue generation, hospital financial data were reviewed from fiscal year 2017 through December fiscal year 2018 (July 1, 2016-December 31, 2017) to identify all patients with an associated vascular surgery charge during admission or within 72 hours after discharge. Patients admitted to vascular surgery, established vascular surgery patients, and patients with vascular laboratory charges only were excluded. In this case study, 408 patient encounters were identified, of which 215 had an associated operative or procedural charge and 193 had a consultation charge only, representing a total contribution margin of $3,065,914 ($638,732/clinical FTE). Consultations originated from all inpatient medical and surgical specialties, with 58% of consultations from medical services and 42% from surgical services. Consultations from surgical services were more frequently associated with an operative or procedural intervention (70% vs 30% consultation only), whereas medical consultations were less frequently associated with an intervention (40% vs 60% consultation only). Mean technical revenue, professional revenue, net revenue, and contribution margin were greater among encounters including an operative or procedural intervention (Table). Government insurance programs represented the majority of payers (55% Medicare, 12% Medicaid, 24% private, 6% other, 2% self-pay). As can be seen from the Table, the average contribution margin was more than $7000 per case.

Summary

In considering the value of both the direct revenue from the vascular surgery service line and the indirect revenue from off-service vascular consultations, the average contribution margin per clinical FTE derived from the case studies was $1,525,216. An additional positive indirect impact of vascular surgery on hospital revenue relates to the high CMI of vascular surgery patients. Vascular patients are generally some of the most complex patients with the greatest degree of comorbidities of any patients within the hospital setting. The higher vascular patient CMI has a significant impact on increasing the hospital-wide CMI. The importance of the vascular service line in hospital-wide CMI should not be underestimated as this can result in significant increased revenue from the Centers for Medicare and Medicaid Services (CMS) for all hospitalized government-insured patients.

The financial data described here can be used as a starting point to develop a physician compensation plan that more thoroughly addresses the importance of the surgeon

Table. Vascular surgery service revenue generation

	Technical revenue	Professional revenue	Net revenue	Contribution margin
Consultation only	33,139 ± 72,815	4622 ± 12,239	37,760 ± 82,570	7252 ± 42,127
Operative/procedure	68,092 ± 114,061	10,860 ± 21,970	78,952 ± 132,053	7750 ± 74,697
Total	51,558 ± 98,220	7909 ± 18,281	59,467 ± 113,177	7514 ± 61,409

Values are reported in dollars as mean ± standard deviation.

in adding not only to the overall financial health of the health care system but also to patient safety.

The presence of vascular surgery in the health care system is critical to the safe provision of a broad array of complex innovative surgical therapies. In addition, vascular surgery presence is paramount to maintaining a safe OR environment because of the vascular surgeon's role in dealing with unexpected intraoperative vascular emergencies, such as catastrophic bleeding or ischemia.

VALUE OF VASCULAR SURGERY IN FUTURE ALTERNATIVE PAYMENT MODELS

Health care cost in the United States consumes a disproportionate share of the gross domestic product compared with other high-income countries. Although it is unclear what "appropriate" percentage of the gross domestic product health care should consume, with the passage of the Affordable Care Act, there has been a transformative push in health care to rein in rising health care cost and at the same time to improve quality. It has become incumbent on health care professionals to improve the value of the care they deliver to patients or populations. Vascular surgeons will have an important role in delivering high-value vascular care.

Fee for service. Currently, most vascular surgery practices exist in a fee-for-service environment. Quality metrics have focused on process measures and not patient outcomes. Vascular surgeons have taken a leadership role in promoting outcome measures through the Vascular Quality Initiative. The Vascular Quality Initiative is the largest registry in the United States focused on defining the outcomes for patients with vascular disease. Many factors have come together to threaten the sustainability of the fee-for-service payment model. These factors include the concerns about solvency of Medicare, the impact of the Affordable Care Act, and the push of private insurers for at-risk or gain-sharing payment models.

At-risk and gain-sharing models of care. These models of care focus on controlling cost per episode of care. The vascular surgeon's ability to contain cost per procedure while maintaining superior outcomes remains central to success. The surgeon's inherent flexibility in offering the full scope of vascular treatments from endovascular to hybrid to open surgery and wound care allows efficient patient care without the pitfalls of requiring coordination of multiple different specialists needing to deliver a similar treatment plan. In addition, vascular surgeons have been shown to provide high-quality, low-cost care compared with many other specialists. An example of this is a study that showed vascular surgeons' per episode of care for carotid endarterectomy to be equal to or lower than that of other surgical specialists while providing outstanding outcomes.[13]

Bundled payment models. Bundled payment models in which the health care system receives a payment for a complete episode of care during a prespecified time require that the service provided is not only low cost with superior outcomes but also durable. In this care model, vascular surgeons are able to provide the full scope of vascular care and are in a unique position to choose the procedure that will have the lowest cost and best outcome in the long term. This may be very different from treatments that may be low cost and have good short-term results but require multiple reinterventions during the follow-up period.

Capitation. Full capitation is slowly increasing penetration into the health care market system. Health care systems such as Kaiser Permanente have successfully managed population health, but now states such as Maryland have worked with the CMS Innovation Center to provide full capitation of the state's Medicare population.[14] In capitated payment models, there are many challenges around patient attribution and coordination of care; however, these alternative payment models have significant support from the CMS. In these models of care, specialists shift from revenue-generating centers to being viewed as cost centers. Defining features for cost containment focus to a lesser degree on cost per episode of care and more on utilization rates. Vascular surgeons will thrive in this environment. Vascular surgeons have a long track record of promoting conservative vascular care based on long-term outcomes. This has been to some degree detrimental in the fee-for-service world. Vascular surgeons have consistently maintained strong advocacy for appropriateness of interventions, and this will be an important contribution to controlling cost of vascular care in the capitated environment.

HOW TO HIRE AND RETAIN A VASCULAR SURGEON

Resources

Promoting and posting the position are relatively simple, but offering an attractive opportunity with the right pieces and finding the right surgeon to fit that position are much more challenging. Numerous physician placement entities are available for a fee. However, the Society for Vascular Surgery has a section on its website where new positions can be listed without a fee. In the sections that follow, we outline the ingredients that make up a successful recipe for recruiting and retaining a vascular surgeon for all settings, including academic and private, hospital employed, and community practice. A checklist that details all of the points delineated and that may be used by administrators and vascular surgeons considering employment opportunities is provided (Supplementary Table, online only).

Expectations

At the beginning, the expectations for the new vascular surgeon should be delineated as clearly and specifically as possible. The focused areas that must be detailed include the surgeon's responsibilities, scope of practice, credentialing, salary (and benefits), incentives, time and contractual obligations, and educational/academic requirements. More global issues to be clarified are quality of life issues for the surgeon and family, group governance, program support and development, career enhancements, mentoring, and retention.

Vascular surgeons entering an academic or semiacademic practice will have roles in clinical production, in education, and in research. Additional administrative and community activities may be involved early. Educational and research time requires funding from sources other than the clinical account. The expectations for the new vascular surgeon should be delineated as clearly and specifically as possible. The focused areas within clinical education and research practice should be explicit. The recruitment proforma must be detailed and include the surgeon's responsibilities, scope of practice, credentialing, salary and benefits, incentives, time and contractual obligations, and educational/academic requirements. Funding sources should be clearly defined. Any faculty and program support should be delineated in terms of allocation, duration, and potential payback. Recruitment enhancements (startup funds) and limitations (time limit for transition to independence in research) should be clarified.

Responsibilities

Clinical. The global and specific responsibilities of an appointment must be clear with regard to both primary and secondary sites of service. Important logistics include expectations to complete and to maintain licensing and credentialing, application for appropriate privileging with case logs, description of clinic staffing and schedule, and description of call schedule and any backup schedules. The surgeon's required availability for call has to be clearly stated. For faculty members, involvement with residents at all sites should be clearly understood. Additional requirements are the process of clinic schedule alterations, coding practice and audit, acceptable lag times for clinical documentation, leave requests, and administrative time.

Educational. In an academic setting, there will be medical students, residents, and fellows. The requirements for teaching, conference attendance, and graduate medical education duties should be clearly delineated. It should be clear whether performance against educational benchmarks is tracked and reimbursed directly or indirectly.

Research. If the faculty member has a research interest, the sources, type, nature, duration, and use of startup funds should be clearly stated, and explanations of ramp ups or ramp downs, depending on the candidate's success, should be stated. Integration into existing research structures and identification of mentors must be well described and plans developed. If it is offered, protected time should be defined and understood by both sides. A higher research component will affect salary and incentives compared with 100% clinical faculty.

Scope of practice

The scope of practice varies by location and is determined by practice setting and the local medical environment. Access to new patients, methods to ramp up a practice, and case mix should be understood and clearly disclosed. Additional considerations are the vascular surgeon's role in a vein center, wound center, or office-based laboratory. Expectations to support spine exposures, trauma, and podiatric-type procedures (toe and foot amputations) must be disclosed. Any restrictions on practice with regard to stroke, carotids, or central venous interventions must be disclosed as well. In an academic practice, achieving a niche or a recognized area of expertise takes time and a strong track record. The applying vascular surgeon should be cautious as asking to be recognized as a specialist in a particular area can be counterproductive to negotiations.

Credentialing

The credentialing process for the group, covered hospitals, and insurance companies should be reviewed. For instance, if case logs, additional training courses, or certification (such as Registered Vascular Technologist, Registered Physician in Vascular Interpretation, or Advanced Cardiac Life Support) is required for credentialing, this

should be disclosed. The presence of a full license may be required before a final employment offer may be made. Candidates should ensure that they have not been named unknowingly in a legal matter that may slow their credentialing or that they have appropriate contracts in place with the state board's wellness committees if necessary.

Governance structure

The governance of the employer varies by entity. Independent community practice groups should disclose the governance structure for the group, and certain details are important. Is the surgeon being offered a partner track or non-partner track? At what point is the new surgeon given authority and to what extent (eg, limited to scheduling and workflow vs larger group issues, such as adding associates or capital expenses)?

The governance structure of an academic practice is generally hierarchical and classical with sections, divisions, departments, and the deanery. Service lines and merged entities blur these distinctions and have significant consequences in terms of lines of direct and indirect reporting, access to patients, control of revenue, and dispersal of compensation and incentives. In general, the service line and school control hiring, firing, scheduling, and workflow issues. The faculty member is an employee and remains an employee of the academic entity and thus is governed by the employee policies and procedures of the entity. Access to the faculty handbook should be made available.

Salary

Base. The compensation model must be clearly stated. This includes the base salary plus any incentives or bonus. If there are incentives or bonuses, it has to be exactly explained as to how these are determined, and the details should not be vague in any way. In the independent community practice situation, the compensation possibilities include an RVU model, straight income model, straight billing model, and blended models.

At risk. The offer and contract should clearly state whether there are salary limits or reductions for working less than a full schedule for various reasons, such as illness, disability, and childbirth. If personal time off (PTO) benefits can be used to offset this, it should be noted.

Backstop. If the community practice has a buy-in for partnership, the methodology should be delineated, including whether an accelerated buy-in can occur through salary reduction. For an academic position, the compensation scheme in the contract should be clearly stated as an RVU model, straight income model, straight billing model, or blended model. In general, most academic groups draw guidance on their salary structures from industry-provided tables, and the 50th percentile is the norm as an offer. Some of the commonly used compensation tables are available from the Medical Group Management Association, the American Medical Group Association, and the American Medical Association. The 50th percentile can vary by geographic location and whether the practice is in an urban or rural setting. These salary tables typically are based on RVUs. Therefore, procedures that have relatively low RVU totals, such as varicose vein surgery or TOS procedures, may generate substantial technical revenue for the health care system yet little professional revenue for the surgeon. This may be segmented into a guaranteed salary and an "at-risk" salary, which may range from 10% to 50% of the salary offer to allow financial protection to the employer. In return, the employer should be able to offer a productivity bonus above the base salary that is achievable and equitable. Calculation of at-risk salary should be clearly stated and the goals achievable. The timing of the payments of the at-risk component should be clear. Dispersal of incentives based on ad hoc personalized criteria or no criteria is to be avoided. There is an educational penalty working with residents that should be considered if the contract is completely based on productivity, and thus RVU or cash benchmarks should be mitigated by 5% to 10% from benchmarks used in independent practice. A research incentive should be present if research is a component of the vascular surgeon's overall responsibilities and expectations. The academic contract often will have language to limit payouts if the entire multispecialty group, department, or division is in deficit, and this should be discussed and understood as it has a material impact on salary. The offer and contract should clearly state whether there are salary limits or reductions for working less than a full schedule for various reasons, such as illness, disability, and childbirth. If PTO benefits can be used to offset this, it should be noted. Additional incomes from technical fees, call coverage, directorships, and hospital- or school-required committee work should be defined and their dispersal understood. If the group has service locations that are significantly separated by either distance or travel time, it should be clear how the group minimizes the impact on the length and disruption of the workday.

Benefits

Potential benefits that may be offered as part of the compensation to enhance the appeal of a position are pension, disability, continuing medical education, loan repayment, sign-on bonus, mileage reimbursement between sites, malpractice tail coverage, and relocation allowance. If the surgeon later vacates the position, it should be understood up front who is responsible for any tail coverage.

Benefits in an academic practice are generally drawn from the parent institution. The nature of the home institution as a private, mixed, or state-owned institution will influence the guidance on pension and disability; continuing medical education allowances are generally allocated at the departmental or divisional levels and must be stated in the contract. There should be a description of potential insurance coverage and its tail coverage.

Incentives

If the group is receiving payments from facilities for call coverage, it should be clear how those are shared with the members. If the group is receiving payments from facilities for call coverage, directorships, or committee work, how those are shared with the members should be clarified.

Clinical, educational, and academic obligations

There should be a clear delineation of the clinical track to which the faculty member is being hired and an understanding of the benefits and risks of tenure. Promotion is an important process in academic medicine, and the criteria, timelines, and support to achieve this should be defined. In addition to faculty affairs, faculty development should be discussed so common expectations are established as to the timing of incremental education or coursework, development of administrative and leadership skills, and growth of local or regional and national reputations. These desires and requests must be aligned with the institution and the division.

In the independent community vascular practice, there is tension between these competing necessities (clinical, educational, and academic). A frank discussion should be held before employment as to how these are and will be managed.

In the next section, we discuss the basic support and logistics that a vascular surgeon will be using to evaluate the nonfinancial aspects of the position that are in many ways just as important as the components discussed in the preceding sections, if not more so. These directly relate to the vascular surgeon's quality of work life. The institution's investment and commitment to these areas demonstrate its commitment to the surgeon and the vascular service line and in the end determine whether the surgeon evaluates the opportunity as one that puts her or him in a position to succeed or to fail.

Office and clinic

Space is essential and will be the patient's first impression of the surgeon and practice and perhaps the only impression if surgery or intervention is not necessary or offered. Is the office at the hospital, on campus, or remotely located? Is the vascular surgeon expected to attend office in multiple locations or outreach locations? What is the expectation for office appointments when an emergent case conflicts with office commitments unexpectedly? Can procedures be performed in the office and is the office amenable to outpatient vein center activity?

Open surgery OR

Block time availability is often regarded as the single largest determinant of productivity. The OR is among the scarcest of resources at many busy hospitals and is incredibly expensive for even a few minutes of time. Adequate access to appropriate OR time is vital. Confirm that the proposed times are in line with the surgeon's expectations for amount and parts of the week. Not infrequently, new surgeons are offered Friday afternoons only. This may not be when new surgeons wish to do their most tedious or complex cases. Transparency as to the OR time allotment is paramount. This may be a frequent source of contention within some practices. Ideally, OR schedule availability will adapt as the new surgeon's practice grows, although this is not always automatic and may need to be negotiated over time. It should be clear which cases can be booked through the office and which must be booked by the surgeons themselves after hours or on the weekends.

Interventional suite and cardiac catheterization laboratory

Access to outpatient catheter-based procedure time with appropriate assistance and supply availability is critically important for the modern vascular surgical practice. Also, sedation privileges, availability of anesthesia backup, sheath pull services, and postprocedure monitoring practices will be important to new vascular surgeons entering practice.

Hybrid OR

Many vascular surgery procedures today occur (or should occur) in the hybrid OR (endovascular aneurysm repair, thoracic endovascular aortic repair, TCAR, fenestrated grafting, hybrid lower extremity or inflow revascularization, others). Yet, hybrid OR access may be limited or already oversubscribed at any given center. On-call access *with appropriate staffing* can be particularly contentious at some centers. Conversely, being forced to use a hybrid OR without the option to have a traditional OR bed or without a specialized fluoroscopy table that is also a good OR bed (uncommon that hybrid ORs have a good true open operating table) may also be a challenge.

C-arm access

Availability is critical, and access to on-call technologists may not always be unlimited. Some hospitals have limited the number of available technologists even during prime times but certainly at night on the weekends. Thus, even if anesthesia, nursing, and scrub tech are available, a room may be held for lack of C-arm access. Availability of C-arm is essential to fluoroscopically guided

procedures and may also suffice for some procedures when access to a hybrid OR is not available as well.

Vascular laboratory

Again, multiple important questions need to be answered in regard to the vascular laboratory as these laboratories function differently in different locations. Who interprets the studies, and how does a new vascular surgeon get on the reading schedule? Is there access to existing modern laboratory interpretation software? What are turnaround, reporting expectations? Is the laboratory managed by vascular surgery, radiology, or other entities or jointly managed? Is the laboratory Intersocietal Accreditation Commission certified? Do readers collaborate in some standard fashion if a high volume of laboratory studies is pending to be read? Nonparticipation in the vascular interpretation schedule (with attendant loss of revenue/productivity) is rarely financially viable in vascular surgery practice and can lead to loss of certification.

In-office procedure room

Central access device removal, small local wound procedures, skin biopsy, outpatient vein procedures, and others may be best accomplished in a procedure room within an office. Is such a room available? Is it adequate for performance of such procedures (lighting, space for devices/assistants, suction, electrocautery)?

Wound care center

What commitments to the wound center will accrue to the new vascular surgeon? Can the vascular surgeons send chronic wounds that will need long-term maintenance to the wound center? Do they keep control/responsibility of subsequent procedures in that patient or are they delegated to a wound care surgeon? Is there good collaboration between the wound care center and vascular surgery practice? How are costs from the wound center accounted for from a budgetary standpoint? Who covers nighttime wound patient calls regarding late nurse calls, antibiotic problems, dressing questions, and intravenous access issues?

Telemedicine

Telemedicine will be an increasingly viable alternative to long-distance outreach visits in person. This may be a much more efficient use of a vascular surgeon's time to evaluate consultations that involve an opinion only or advice about medical management. Many cases from outreach facilities are brought to the larger center for treatment eventually as well, so telemedicine could represent significant potential practice efficiency as well as an asset to overall lifestyle by eliminating additional commuting. Also, telemedicine is increasingly a billable service in many states. The technology to offer this must exist or be obtained, however, and it must be considered acceptable within the practice, system, and region.

Seven-day/week coverage

It is generally considered unhealthy to be on call at all times, even if it is in a low-volume call scenario, from a physician's wellness standpoint. Shared coverage arrangements should be clearly delineated and well understood. How patients are shared within such arrangements is often complex, potentially hierarchical, and often critical to both a new surgeon's success and work-life balance.

Equipment and infrastructure needs

Fluoroscopy-capable tables. Appropriate vascular operating tables are essential and may not be unlimited in a given OR. Consideration of access to a proper vascular operating table should be considered in evaluating a given OR.

Surgical instruments and trays. Various types of trays, their availability, turnaround, and other factors may limit OR booking or numbers of cases per day.

Basic endovascular inventory. Basic endovascular tools should be available and located in the room where they are used or be immediately available nearby or on movable carts. This will reduce procedure time and limit costs and opportunity cost losses.

Advanced endovascular inventory. Advanced endovascular inventory represents an important expense to the hospital. This may include stent graft components, rarely used devices, and thrombectomy devices in some cases. The hospital may purchase some or keep some on consignment, or the surgeon may need to attempt to secure or to arrange their provision on an ad hoc basis for each case. In some cases, certain devices may or may not be available for consignment, but this is usually negotiated by the hospital.

Ancillary endovascular equipment. If the vascular service line provides or wishes to provide advanced endovascular treatments, investment in additional equipment or devices is warranted. These include advanced fluoroscopy imaging with three-dimensional fusion, high-quality computed tomography (256-slice and gated), advanced computed tomography processing software (TeraRecon [Foster City, Calif], 3mensio Vascular [Pie Medical, Bilthoven, The Netherlands]), percutaneous thrombectomy devices, and percutaneous pulmonary embolectomy devices.

Cell Saver. Availability of the Cell Saver (Haemonetics, Braintree, Mass) is essential to reducing perioperative transfusion in some cases and may not be able to be planned for. Circulating nurses, dedicated trained nurses, perfusionists, or others may be required to run it.

Administrative support. This position is essential for smooth and efficient service line functioning. The role should handle OR, clinic, catheterization laboratory, and other scheduling commitments and manage referrals, meetings, and time commitments. This is the often

overlooked "secret weapon" in a successful surgical practice.

Advanced practice provider. Nurse practitioner or physician assistant support is vital in the modern era. With or without residents in the mix, these professionals are vital to success. They take care of the redundant and repetitive aspects of preoperative and postoperative orders, clinic, outpatient phone calls, and other recurring activities with greater efficiency than many surgeons themselves.

Nursing support. Dedicated nursing support in and out of the OR with professional registered nurses (RNs) who are focused on vascular surgery is a definite asset.

Medical assistant support. Most clinics are staffed by medical assistants. Whereas the medical assistants may be from a rotating pool, it is preferable that they see primarily vascular or even primarily surgical patients in their typical clinic setting.

Vascular surgery-competent open team. As open procedures become less common, especially open abdominal and to some extent lower extremity cases, scrub tech and OR circulating RN teams who can optimally facilitate these cases often must be hand selected. The system should consider having an existing open vascular OR team with access and availability defined.

Endovascular-competent open team. Likewise, as endovascular procedures become more complex, scrub tech and OR circulating RN teams who can optimally facilitate these cases often must be hand selected. The system should consider having an endovascular/hybrid vascular OR team with access and availability defined.

Personnel support

Program coordinator. Overall coordination of the vascular program, whether community or academic, is essential to correct program navigation, growth, and long-term stability. This may be in the form of a dyad between the chief or medical director and an administrative person or be purely performed by the administrator. Good program coordination and administration are also absolutely vital to professional success as well as to quality of life.

Ancillary support

Having the appropriate medical support in place for the vascular service line is essential. Vascular surgery patients are typically complex patients with multiple life-threatening chronic comorbid illnesses. It has been shown that the involvement of a skilled hospitalist improves the outcomes and shortens the length of stay of vascular patients. Seriously ill vascular patients or those in the early phases of recovery after a high-risk procedure are best managed in conjunction with an intensivist who is available to respond rapidly to acute changes in the vascular patient's condition more than the vascular surgeon who may be involved in procedures, thereby delaying care and rescue from complications. Allied health personnel (such as nurse practitioners and physician assistants) are instrumental in extending the capabilities and reach of the vascular surgeons and therefore are considered a key component of the vascular team.

The vascular service line patients have a high incidence of cardiac and renal disease necessitating the presence of vigorous cardiology and nephrology service lines to provide essential care to these patients. The increasing incidence of peripheral arterial occlusive disease has led to an increase in diabetic foot wounds as well as the number of amputations being performed annually. To fully support this part of the service line, podiatry support and some form of orthotics support (either in house or through external arrangements) should be in place for the best care of these patients and to support the vascular surgery team.

IT support. The time demands on providers to perform increasing amounts of clinical documentation for an increasing number of encounters per day is exceedingly stressful, a significant contributor to medical errors, and the leading cause of physician burnout. To minimize this, it is essential to have a friendly and efficient electronic environment for the vascular surgeon. The facility should have in place one of the more efficient and robust electronic health record systems that is also reliable and interfaces the hospital and clinic as well as imaging and satellite facilities within the hospital system. Invaluable components of this type of electronic health record are vascular service line order sets and documentation templates. The IT support for the vascular service line should be identified, visible, and capable of assisting with maintaining and troubleshooting the unique needs of the vascular service line. Providing additional equipment as needed, such as pagers, cellphone, laptops and computers with high resolution, fast processors, and large RAM cache, is important to ensure that the vascular service line runs smoothly and efficiently while it manages large volumes of clinical and imaging data.

Quality support. In the new era of "pay for performance," participation in a recognized quality registry is a must. Several, such as the Vascular Quality Initiative, National Surgical Quality Improvement Program, and National Cardiovascular Data Registry, are available. At least one FTE will be necessary to upload the quality data, and depending on the volume of the service line, more may be necessary. This not only demonstrates the commitment to quality but provides real-time feedback to promote improvements in the vascular service line's care. In addition, there should be appropriate support to carry out process improvement projects on outcomes reported in the registry.

Peer review. In larger institutions, peer review of cases is done by another vascular surgeon. However, if the peer review is being done by a competitor, that should be disclosed, and assurances should be made to prospective vascular surgeons that the peer review process will be fair and focused on patient care quality without bias. In smaller facilities, there may not be another vascular surgeon to perform peer review. In that case, it should be disclosed whether the peer review is being done by another vascular proceduralist or even a nonvascular specialist. In any of these situations, if a potential conflict exists, outside peer review should be available.

Program support

Administrative support. How much of the nonclinical duties, such as credentialing, licensing and malpractice forms, insurance forms, and practice-related travel arrangements, is the physician responsible for doing personally? What ancillary support is available?

Coding support. How is the billing done? Is this done completely by billing people (whether in house or third party), or is the surgeon responsible for coding all of the charges? If so, what support is provided (current *International Classification of Diseases, Tenth Revision* and *Current Procedural Terminology* manuals, attendance at the Society for Vascular Surgery coding course)?

Scribes. Are these provided? Does the group or individual pay their salary and benefits?

Electronic medical record (EMR)

A preview of the EMR is essential. The hiring entity must have an acceptable EMR that is facile to use, completely integrated into the clinic and hospital, and accessible from outside the hospital and clinics.

Program development

Physician liaison. Does the group or hospital promote the arrival and skills of the new vascular surgeon? How?

Advertising. Is there a budget for this? Who pays?

Career enhancements. As new technologies and treatments come on line, how does the group develop this? If the surgeon wishes to obtain additional training (TCAR, as an example), is time off given for this? Who pays?

Mentoring

Increasingly, surgeons fresh out of training are seeking employment where mentoring for the first few years is provided. The group should have a well-established and specified mentoring plan in place to support the new surgeon as the transition is made to the role of attending surgeon.

Retention

Perhaps one of the most overlooked but important areas of physician hiring is the retention strategy. Up to 50% of physicians may relocate after their first job. There should be a retention strategy in place that provides a timeline for salary and autonomy augmentations as well as scheduled reviews for the surgeon to discuss the important negatives that need to be addressed.

Quality of life

Many times, these are the forgotten but essential details of hiring a new vascular surgeon. What value does the community hold for the surgeon and the surgeon's spouse and family in regard to an enjoyable place to live? Are there adequate employment opportunities for the spouse? Are the educational and recreational opportunities desirable as well? Is the housing reasonable in regard to quality and location and commuting?

Vacation

How much? Is it paid? Is PTO used for vacation or can it be used for extra time off? What is the hierarchy for requesting and granting time off, especially for important holidays?

Governance

In a multiperson community group, there will be an inherent hierarchy (either stated or unstated). This should be clarified at the outset, and if there is a specific reporting structure, the new hire should be told. New surgeons need to be informed as to the leadership structure of the service line at the hospitals and clinics and to what extent they will have input. Control of case mix needs to be clarified if this is random (based on clinic referrals, emergency department coverage, or hospital consultations) or if this is in some way controlled by the group's structure or scheduling intricacies. The prospective surgeon should be informed as to the group's philosophy regarding transfers and if specific arrangements are in place with referring physicians or hospitals. For incoming transfers, is the expectation to "accept everything," "selectively accept," or "never accept"? In regard to outgoing transfers, is that the expectation for certain cases because of complexity or diagnosis, or is it to never transfer?

CONCLUSIONS

Vascular surgeons provide an important service in a complete health care system. They are capable of treating a wide range of disease processes that affect both the venous and arterial systems. Their presence broadens the complexity and diversity of services that a health care system can offer, both in the outpatient setting and in the inpatient setting. They are critical to a safe OR environment. The vascular surgery service line has a positive impact on hospital margin through both the direct vascular profit and loss and the indirect result of assisting other surgical and medical services in providing care. The financial benefits of a vascular service line will hold true for a wide range of alternative payment models, such as bundled payments or capitation. The needs of modern vascular surgeons, to fully use their skill set, require

significant investment from the health care system, but it is appropriate, considering the substantial return on the investment.

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Conception and design: RP, KB, MD, JoH, JeH, BJ, MM, AS, WS, FW, JW

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Statistical analysis: Not applicable

Obtained funding: Not applicable

Overall responsibility: RP

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Submitted May 18, 2020; accepted May 20, 2020.

Additional material for this article may be found online at www.jvascsurg.org.

Supplementary Table (online only). Checklist for resources

Vascular surgeon's equipment and facility needs

Criteria	Description
Facilities	
Office	
Open OR	
C-arm access	
IR suite catheterization laboratory	
Hybrid OR	
Vascular laboratory	
In-office procedure room	
Wound care center	
Telemedicine	
Time	
7-day/week coverage	
Access to OR schedule	
Access to catheterization laboratory schedule	
Equipment	
Fluoroscopy-capable tables	
Surgical instruments and trays	
Endovascular inventory, basic	
Endovascular inventory, advanced	
Ancillary endovascular equipment	
Cell Saver	
Mechanical thrombectomy devices	
Venous ablation systems	
Personnel	
Administrative support	
Advanced practice provider	
Nursing support	
Medical assistant support	
Vascular surgery-competent open team	
Endovascular-competent open team	
Surgical assistant	
Program coordinator	
Ancillary support	
Hospitalist	
Nephrology	
Cardiology	
Intensivist	
Orthotics	
IT support	
Pager/cellphone	
EMR	
Order sets	
Documentation templates	
Quality support	
Vascular Quality Initiative	

How to hire a vascular surgeon

Setting	Academic		Community	
Employment type	Employed	Contracted	Hospital employed	Independent
Criteria				**Description**
Business case				
Expectations				
Responsibilities				
Scope of practice				
Credentialing				
Governance structure				
Salary				
Base				
At risk				
Backstop				
Benefits				
Pension				
Disability				
CME				
Malpractice				
Loan repayment				
Sign-on bonus				
Mileage between sites				
Call requirements				
Incentives				
Call pay				
Structure				
Reimbursement level				
Directorships/committee work				
Time allocations				
Clinic				
OR				
Endo suite				
Administration				
Contractual obligations				
Cost allocations and structure				
Term				
Renewal				
Non-compete				
Clawbacks				
Partnership				
Non-partnership				
Tenure				
Non-tenure				
Clinical obligations				
Educational obligations				
Academic obligations				

(Continued on next page)

Continued.

Criteria	Description
Quality of life	
Spouse	
Children	
Vacation	
Locums/coverage	
Geography/coverage	
Governance	
Supervisor	
Service line	
Control of case mix	
Transfer policy and arrangements	
Peer review	
Program support	
Advanced practice provider support	
Administrative support	
Coding support	
Scribes	
EMR	
Program development	
Physician liaison	
Advertising	
Directed referrals	
Career enhancements	
Mentoring	
Retention strategies	

CME, Continuing medical education; *EMR*, electronic medical record; *IR*, interventional radiology; *OR*, operating room.