Supplemental Guide:
Vascular Surgery

ACGME

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Milestones Supplemental Guide

This document provides additional guidance and examples for the Vascular Surgery Milestones. This is not designed to indicate any specific requirements for each level, but to provide insight into the thinking of the Milestone Work Group.

Included in this document is the intent of each Milestone and examples of what a Clinical Competency Committee (CCC) might expect to be observed/assessed at each level. Also included are suggested assessment models and tools for each subcompetency, references, and other useful information.

Review this guide with the CCC and faculty members. As the program develops a shared mental model of the Milestones, consider creating an individualized guide (Supplemental Guide Template available) with institution/program-specific examples, assessment tools used by the program, and curricular components.

Additional tools and references, including the Milestones Guidebook, Clinical Competency Committee Guidebook, and Milestones Guidebook for Residents and Fellows, are available on the Resources page of the Milestones section of the ACGME website.

Patient Care 1: Patient Data **Overall Intent:** To assess adequacy of a detailed history and clinical examination to arrive at a clinical diagnosis	
Milestones	**Examples**
Level 1 *Elicits and presents a history and performs a vascular examination relevant to the patient's presenting complaint*	• Elicits details of duration, onset, progression, aggravating or relieving factors for specific symptoms such as pain; identifies characteristics of peripheral arterial disease • Elicits relevant family history, assesses level of disability in activities of daily living, work, and recreation • Documents systemic comorbidities such as diabetes, or hypertension; documents previous vascular procedures and access and details of current medications • Elicits symptoms of venous disease such as skin change, ulceration, history of use of compression garments, and previous episodes of thrombosis
Level 2 *Orders and interprets diagnostic testing; establishes differential diagnosis*	• Orders an ankle-brachial index and other relevant vascular laboratory duplex studies • Identifies the need for exercise ankle-brachial index and orders when relevant • Recognizes need for imaging for those with critical limb ischemia • Checks renal function before ordering contrast-based imaging-computerized tomography (CT)/magnetic resonance (MR) angiography
Level 3 *Synthesizes patient data, including diagnostic imaging, to arrive at an organized hierarchical differential diagnosis for basic disease processes, to include primary and secondary treatment options*	• Diagnoses peripheral arterial disease and the Rutherford stage for chronic limb ischemia • Identifies the traditional Clinical-Etiology-Anatomy-Pathophysiology (CEAP) stage and is aware of the revised CEAP classification • Diagnoses acute and chronic mesenteric ischemia • Diagnoses acute and chronic extremity ischemia • Identifies indication for venous imaging, duplex/CT venogram, and basic work-up for thoracic outlet syndrome
Level 4 *Synthesizes patient data, including diagnostic imaging, to arrive at an organized hierarchical differential diagnosis for complex disease processes with advanced comorbidities, to include primary and secondary treatment options*	• Diagnoses and offers management plan for thoracic outlet syndrome • Diagnoses and offers treatment options for aortic dissection and aortic emergencies • Discusses endovascular versus open repair of aortic aneurysms • Discusses management of carotid artery disease, including endarterectomy versus transfemoral stenting versus transcarotid artery revascularization • Discusses management of vasculitis, graft infection, vascular tumors, vascular malformations, popliteal entrapment, and occupational vascular disorders
Level 5 *Synthesizes patient data, including diagnostic imaging, to arrive at an organized hierarchical differential diagnosis for rare disease processes and variants of complex disease processes*	• Recognizes rare congenital syndromes with vascular manifestations

Assessment Models or Tools	• Direct observation • Faculty member evaluations • Mock orals/case scenarios discussion • Observation in inpatient/outpatient settings
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131. • Moore WS. *Moore's Vascular and Endovascular Surgery: A Comprehensive Review*. 9th ed. Philadelphia, PA: Elsevier; 2019. ISBN:978-0323480116. • Society for Vascular Surgery. Clinical Practice Guidelines. https://vascular.org/research-quality/guidelines-and-reporting-standards/clinical-practice-guidelines. 2020. • American College of Surgeons. Guidelines. https://www.facs.org/about-acs/guidelines. 2020. • Wolters Kluwer. UpToDate. https://www.uptodate.com/home. 2020.

Patient Care 2: Medical Management of Vascular Disease **Overall Intent:** To assess awareness of optimal medical management and the role of non-interventional therapy in the management of patients with vascular disease	
Milestones	**Examples**
Level 1 *Describes risk factors for vascular disease*	• Describes duration, treatment details of diabetes, hypertension, dyslipidemia, family history, chronic obstructive pulmonary disease (COPD) and smoking in a patient with arterial disease or aneurysms • Describes details of activity, lifestyle, medication use, and family history of thrombosis in patients with venous disease
Level 2 *Identifies therapies for risk factor modification*	• Describes details of healthy lifestyle choices, walking programs, smoking cessation, and diet • Lists basic therapeutic options available for nicotine and alcohol cessation
Level 3 *Recognizes endpoints, contraindications, and complications of medical therapy*	• Identifies soft tissue abscess/gangrene and differentiates a dysvascular limb in a patient with an infected/diabetic foot; recognizes need for revascularization • Lists contraindications for anticoagulation and thrombolysis • Checks for polypharmacy and relevant drug interactions • Identifies and formulates a treatment plan for reversal of anticoagulants
Level 4 *Formulates a comprehensive plan of medical management for patients with vascular disease, including risk factor modification*	• Diagnoses peripheral arterial disease based on symptoms and orders non-invasive labs and lifestyle management for non-limb-threatening ischemia, with appropriate follow-up plans • Orders relevant blood tests, tests needed for peri-operative risk assessment electrocardiogram (EKG), pulmonary function test, and imaging for patients with large aneurysms or limb threatening ischemia • Uses advanced therapy for hyperlipidemias
Level 5 *Proposes novel medical treatment algorithms based on new literature*	• Discusses the treatment options, timing of interventions, and medical management for low-frequency vascular diseases • Incorporates emerging literature into bedside decision making
Assessment Models or Tools	• Direct observation • Faculty member evaluations • Mock orals/case scenarios discussion • Observation in inpatient and outpatient settings • SCORE Curriculum Outline for Vascular Surgery (VSCORE)
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913.

	• Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131. • Moore WS. *Moore's Vascular and Endovascular Surgery: A Comprehensive Review*. 9th ed. Philadelphia, PA: Elsevier; 2019. ISBN:978-0323480116. • Society for Vascular Surgery. Clinical Practice Guidelines. https://vascular.org/research-quality/guidelines-and-reporting-standards/clinical-practice-guidelines. 2020. • American College of Surgeons. Guidelines. https://www.facs.org/about-acs/guidelines. 2020.

Patient Care 3: Peri-Operative Care **Overall Intent:** To assess the identification, work-up, and management of peri-operative problems in vascular surgical patients	
Milestones	**Examples**
Level 1 *Manages basic peri-operative problems (e.g., fever, pain)*	• Works up a fever based on most common causes of post-operative fever such as chest x-ray, urine culture, blood culture, or presence of indwelling catheter • Addresses pain scores and manages pain based on procedure performed and the World Health Organization (WHO) pain ladder recommendations
Level 2 *Manages common peri-operative problems (e.g., post-operative myocardial infraction), including ordering and interpretation of supplemental tests when needed*	• Orders appropriate testing to identify most common peri-operative issues such as infections such as blood, urine cultures, chest x-ray, wound cultures, or starts appropriate antibiotics, and cardiovascular events such as cardiac enzymes, EKG, starts acetylsalicylic acid (ASA), and prompts cardiology consult, calls code stroke, or CT head

Level 3 *Recognizes and manages complex peri-operative problems, including vascular complications, critical care, and palliative care*	• Determines post-operative vascular complications based on procedure such as:
	  • post-operative bleeding (identifies source, orders blood transfusion and prompts return to operating room as needed)
	  • post-operative ischemia (bowel ischemia after abdominal aortic aneurysm repair, orders adequate testing for diagnosis including gastroenterology consult for flex-sigmoidoscopy, antibiotics, need for exploratory laparotomy if patient unstable)
	  • Bypass or stent thrombosis (identifies changes in vascular exam after revascularization, orders testing for diagnosis if needed such as duplex or axial imaging CT angiography, prompts return to the operating room
	  • post-operative stroke after carotid endarterectomy (differences in management depending on presentation, in the operating room, post-anesthesia care unit, post-operation day one)

Level 4 *Leads team and provides supervision in the evaluation and management of complex peri-operative problems, including vascular complications, critical care, and palliative care*	• Leads team and provides supervision for addressing peri-operative complications and ensures all details of the diagnosis, management, and treatment are in place • Leads multidisciplinary discussion regarding patient care and ensures communication between all consultants has occurred
Level 5 *Works with the interdisciplinary care team to develop new pathways to prevent peri-operative vascular complications*	• Leads an interdisciplinary team to develop a pathway to treat and prevent spinal cord ischemia after thoracic endovascular aortic repair or fenestrated endovascular aortic aneurysm repair • Leads an interdisciplinary team to develop a pathway to prevent hyperperfusion syndrome after carotid endarterectomy or stent
Assessment Models or Tools	• Case scenarios/mock orals with common vascular peri-operative complications • Direct observation • Feedback from co-residents and faculty members based on level of training

	• Semi-annual evaluation • VSCORE
Curriculum Mapping	•
Notes or Resources	• Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *Journal of Vascular Surgery*. 2018;61(1):P2-77. https://www.jvascsurg.org/article/S0741-5214(17)32369-8/fulltext. 2020. • SVS. VQI Risk Calculator. https://www.vqi.org/resources/vqi-risk-calculators-2/. 2020. • Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131. • Hornor MA, Duane TM, Ehlers AP, et al. American College of Surgeons guidelines for the perioperative management of antithrombotic medication. *J Am Coll Surg.* 2018.

Patient Care 4: Longitudinal Care (e.g., Outpatient Management, Screening, Surveillance) **Overall Intent:** To assess the outpatient management of vascular surgical patients including medical management, surveillance, and identifying the need for intervention	
Milestones	**Examples**
Level 1 *Describes and recognizes expected longitudinal care, including outpatient management, screening, and surveillance for patients with basic vascular disease*	• Recognizes need for follow-up appointments and arterial duplex after peripheral intervention • Recognizes need for long-term surveillance for abdominal aortic aneurysms, carotid artery disease, and peripheral arterial disease
Level 2 *Describes the expected longitudinal care for patients with complex vascular disease*	• Knows and recognizes expected normal post-operative findings on common surveillance imaging including fistula duplex, CT angiography after endovascular aortic repair, and carotid stenting duplex criteria • Knows surveillance protocols for asymptomatic disease (e.g., carotid stenosis, small abdominal aortic aneurysm, visceral occlusive disease without chronic mesenteric ischemia) as well as for certain basic procedures and timing of follow-up
Level 3 *Recognizes the impact of disease progression and complications on the longitudinal care plan*	• Identifies abnormal surveillance findings on imaging on patients who have undergone prior vascular procedures (e.g., abnormal bypass graft duplex, re-stenosis of carotid endarterectomy, threatened bypass graft) or have disease progression requiring intervention (e.g., progression to chronic limb threatening ischemia, enlarging aneurysm, chronic mesenteric ischemia) • Discusses natural history of the progression of disease process and changes in treatment required to address the complication or prevent further progression
Level 4 *Independently alters longitudinal care based on disease progression, complications, or patient-specific issues*	• Formulates medical and operative planning options for patients presenting with disease progression or complications • Elaborates on surgical options for particular problems (e.g., treatment approaches for persistent type 2 endoleak with aneurysm enlargement, infection of iliac limb of prior aorto-bifemoral bypass)
Level 5 *Innovates new aspects of longitudinal care for patients with vascular disease by considering the most updated evidence-based guidelines*	• Discusses cutting-edge or alternate procedures for vascular problems in patients who are poor candidates for standard/traditional procedures (e.g., bridging endograft for aortoenteric fistulas, transcaval embolization for persistent type 2 endoleaks, fenestrated/branch aortic arch devices) • Recognizes when patients are candidates for non-traditional procedures and discusses expected recovery and potential complications with patient
Assessment Models or Tools	• Direct observation • Faculty member evaluations • Mock orals / case scenarios discussion • Observation in outpatient settings

	• VSCORE
Curriculum Mapping	•
Notes or Resources	• Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *Journal of Vascular Surgery*. 2018;61(1):P2-77. https://www.jvascsurg.org/article/S0741-5214(17)32369-8/fulltext. 2020. • SVS. VQI Risk Calculator. https://www.vqi.org/resources/vqi-risk-calculators-2/. 2020. • Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131. • Zierler RE, Jordan WD, Lal BK, et al. The Society for Vascular Surgery practice guidelines on follow-up after vascular surgery arterial procedures. *Journal of Vascular Surgery*. 2018;68(1):P256-284. https://www.jvascsurg.org/article/S0741-5214(18)30896-6/fulltext. 2020. • Zierler RE, Dawson DL. *Strandness's Duplex Scanning in Vascular Disorders*. 5th ed. Philadelphia, PA: Wolters Kluwer; 2016. ISBN:978-1451186918.

Patient Care 5: Procedural Preparation **Overall Intent:** To prepare patients for the safe conduct of vascular procedures	
Milestones	**Examples**
Level 1 *Identifies and orders the tests for standard pre-operative optimization* *Prepares patient for surgery, including pre-operative orders and diagnostic tests*	• Orders nothing by mouth (NPO), type and cross match, pre-operative labs where required, and discusses role of anticoagulation, antiplatelet before proposed surgery/intervention and obtains informed consent • Orders vein mapping, arterial Doppler studies, and pre-operative cardiac evaluation before major lower extremity arterial reconstruction procedures
Level 2 *Interprets clinical data to identify opportunities for pre-operative optimization* *For basic procedures, ensures necessary imaging, instrumentation, equipment, devices, and medications are available; positions, prepares, and drapes patient appropriately*	• Discusses need for smoking cessation, optimizing pre-operative nutrition, pre-operative renal replacement therapy, continues with anticoagulants and antiplatelet where indicated; assesses transfusion needs; obtains and interprets pre-operative cardiac, pulmonary evaluation studies and seeks consultation where indicated; understands the role for pre-operative cardiopulmonary optimization including rescheduling elective procedures to reduce peri-operative risk. • Orders pre-operative nutritional supplementation • Uses enhanced recovery after surgery guidelines for pre-operative optimization • Corrects fluid/electrolyte abnormalities prior to any procedure
Level 3 *Recognizes when procedural plan must change due to patient factors or disease progression identified in pre-operative work-up* *For intermediate procedures, ensures necessary imaging, instrumentation, equipment, devices, and medications are available; positions, prepares, and drapes patient appropriately*	• Discusses alternate treatment options and timing of an intervention influenced by anatomical and/or physiological factors • Chooses an endovascular procedure over an open reconstruction or vice versa to arrive at best patient outcome • Uses risk scoring calculators to choose an alternate option including non-surgical/intervention approach
Level 4 *Proposes alternative surgical plan due to patient factors or disease progression identified in pre-operative work-up* *For advanced procedures, ensures necessary imaging, instrumentation, equipment, devices, and medications are available; positions, prepares, and drapes patient appropriately*	• Anticipates the need to change intra-operative course depending on findings and has alternate plans to address the crisis • Understands the futility of a procedure and long-term outcomes, and considers alternate strategy • Anticipates the need to change plans from an inline reconstruction to an extra anatomical location
Level 5 *Proposes novel therapies to address a patient that is not a candidate for standard care*	• Proposes complex endovascular procedure, or open or hybrid procedures in the setting of vascular problems limited by patient's anatomy, physiology, or the pathology

Develops protocols to improve the procedural preparation process	• Proposes treatment options and strategizes approach when working with multiple surgical disciplines • Addresses symptomatic vascular pathology in multiple locations, prioritizing revascularization strategies
Assessment Models or Tools	• Direct observation • Evaluations for transitions of care • Vascular Integrated Technical and Teamwork Assessment for Learning (VITTAL) specific to the level of the procedure • VSCORE
Curriculum Mapping	•
Notes or Resources	• ERAS Society. Guidelines. https://erassociety.org/guidelines/list-of-guidelines/. 2020. • Hornor MA, Duane TM, Ehlers AP, et al. American College of Surgeons' guidelines for the perioperative management of antithrombotic medication. *JACS*. 2018;227(5):P521-536. https://www.journalacs.org/article/S1072-7515(18)31331-0/pdf. 2020. • SVS. Guidelines. https://vascular.org/research-quality/guidelines-and-reporting-standards/clinical-practice-guidelines. 2020. • Brott TG, Halperin JL, Abbara S, et al. 2011 ASA/ACCF/AHA/AANN/AANS/ACR/ASNR/CNS/SAIP/SCAI/SIR/SNIS/SVM/SVS guideline on the management of patients with extracranial carotid and vertebral artery disease: Executive summary. *Circulation.* 2011;124(4). https://www.ahajournals.org/doi/full/10.1161/cir.0b013e31820d8d78. 2020. • Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *Journal of Vascular Surgery*. 2018;61(1):P2-77. https://www.jvascsurg.org/article/S0741-5214(17)32369-8/fulltext. 2020. • SVS. VQI Risk Calculator. https://www.vqi.org/resources/vqi-risk-calculators-2/. 2020.

Patient Care 6: Technical Skills – Open Surgical Skills **Overall Intent:** To assess resident progression as it pertains to acquisition of open vascular procedures	
Milestones	**Examples**
Level 1 *Demonstrates basic surgical skills and performs basic bedside procedures*	• Ties knots, performs simple suturing, removes sutures, places and removes drain, administers local anesthetic, universal precautions and aseptic technique, and performs foot debridement
Level 2 *Demonstrates respect for tissue, and is developing skill in instrument handling* *Performs basic vascular procedures with limited supervision*	• Examples in arteriovenous fistula creation: ○ Dissects artery and vein safely ○ Performs anastomosis with passive assistance
Level 3 *Handles vascular instruments with increasing efficiency of motion during procedures* *Performs basic vascular procedures independently and intermediate vascular procedures with limited supervision*	• Examples in femoral-popliteal bypass: ○ Exposes the common femoral artery independently ○ Exposes the popliteal artery (above or below knee) with limited supervision ○ Able to tunnel ○ Applies vascular clamps appropriately ○ Performs anastomosis independently
Level 4 *Proficiently handles instruments and equipment, uses assistants, guides the conduct of the operation, and makes independent intra-operative decisions; anticipates when assistance is needed* *Performs advanced vascular procedures, including troubleshooting and managing complications with limited supervision*	• Examples in carotid endarterectomy: ○ Dissects the common, internal, and external carotid artery ○ Applies vascular clamps ○ Performs adequate endarterectomy, including placement of tacking sutures where needed ○ Performs patch angioplasty independently
Level 5 *Handles instruments and equipment independently without supervision, guides the conduct of the operation, and makes intra-operative decisions* *Competently teaches intermediate vascular procedures*	• Brings novel operative approach to the Sponsoring Institution • Competently teaches other residents femoral endarterectomy
Assessment Models or Tools	• Direct observation • End-of-rotation evaluation

	• Multisource feedback • Simulation • Video review • VSCORE
Curriculum Mapping	•
Notes or Resources	• In Levels 2-5 it is assumed the resident is performing the complete procedure, including: procedure/equipment set-up; patient positioning; use of aseptic techniques; leading the procedure; and controlling the flow of the procedure • The procedures above are used as examples. The same concepts should be applied to a variety of operations. • Wind GG, Valentine RJ. *Anatomic Exposures in Vascular Surgery.* 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2013. ISBN:978-1451184723. • Chaikof EL, Cambria RP. *Atlas of Vascular Surgery and Endovascular Therapy*: *Anatomy and Technique*. 1st ed. Philadelphia, PA: Elsevier; 2014. ISBN:978-1416068419.

Patient Care 7: Technical Skills – Endovascular **Overall Intent:** To ensure endovascular technical skills are adequate to treat the full spectrum of vascular conditions	
Milestones	**Examples**
Level 1 *Uses ultrasound to demonstrate anatomy for vascular access* *Recognizes the importance of maintaining wire position during wire and catheter exchanges*	• Uses ultrasound to distinguish the common femoral artery from the common femoral vein • Uses ultrasound to identify the common femoral artery bifurcation, including the origin of the superficial femoral and profunda femoris arteries • Assists in endovascular procedures to maintain wire position • Applies Seldinger technique appropriately
Level 2 *Uses ultrasound to safely obtain percutaneous arterial and/or venous access in most patients* *Selects wires and catheters and demonstrates basic wire handling techniques and performs most catheter exchanges without losing wire position*	• Uses ultrasound to insert a sheath into the common femoral artery in patients with normal body habitus and anatomy • Selects the contralateral iliac artery using femoral access • Chooses a proper wire and catheter for diagnostic arteriography of the aorta or lower extremities • Exchanges a flush catheter for a straight or directional catheter without losing wire position • Applies appropriate C-Arm projections to optimize image quality
Level 3 *Performs basic and intermediate procedures* *Troubleshoots and manages basic procedural challenges*	• Reliably performs exchanges without losing wire position during basic and intermediate procedures. • Chooses appropriate wires and catheters for endovascular aortic repair, thoracic endovascular aortic repair, and carotid artery stenting • Selects an alternative wire and catheter combination when initial approaches to wire passage or cannulation fail • Performs case planning for endovascular aortic repair and thoracic endovascular aortic repair with sufficient accuracy to select appropriate endografts • Chooses an appropriate cerebral protection strategy for carotid artery stenting • Chooses patients with suitable anatomy for transcarotid artery revascularization • Cannulates the internal and external carotid artery with adequate dexterity and safety
Level 4 *Performs advanced endovascular procedures with appropriate wire and catheter skills* *Identifies when to select an alternative access site, wire and catheter technique, or approach to troubleshoot complex procedural challenges*	• Identifies anatomic contraindications for fenestrated endovascular aortic aneurysm repair and iliac branched endografting • Performs case planning for fenestrated endovascular aortic aneurysm repair and iliac branched endografting to select appropriate endograft • Proposes upper and lower extremity access for through-and-through access to allow endografts to track through challenging aortic anatomy

	• Appropriately proposes the use of pedal access to treat challenging chronic total occlusions
Level 5 *Suggests novel endovascular therapies for most complex cases, including troubleshooting and managing endovascular complications*	• Identifies unusual treatment or salvage options when standard approaches or on-label devices and techniques will not suffice
Assessment Models or Tools	• Direct observation • Multisource feedback • Simulation • VSCORE • VITTAL
Curriculum Mapping	•
Notes or Resources	• Schneider P. *Endovascular Skills: Guidewire and Catheter Skills for Endovascular Surgery*. 4th ed. Boca Raton, FL: CRC Press; 2019. ISBN:9780429156304. • Chaikof EL, Dalman RL, Eskandari MK, et al. The Society for Vascular Surgery practice guidelines on the care of patients with an abdominal aortic aneurysm. *Journal of Vascular Surgery*. 2018;61(1):P2-77. https://www.jvascsurg.org/article/S0741-5214(17)32369-8/fulltext. 2020. • Lal BK, Jordan W, Kashyap VS, et al. Clinical competence statement of the Society for Vascular Surgery on training and credentialing for transcarotid artery revascularization. *Journal of Vascular Surgery*. 2020;72(3):P779-789. https://www.jvascsurg.org/article/S0741-5214(20)31312-4/fulltext. 2020.

Patient Care 8: Vascular Imaging (Computed Tomography (CT), Magnetic Resonance (MR), Angiography, Ultrasonography) **Overall Intent:** To use vascular imaging for accurate diagnoses and planning treatment of the full spectrum of vascular conditions	
Milestones	**Examples**
Level 1 *Identifies the various types of imaging modalities*	• Recognizes that gadolinium is contraindicated in patients with an estimated glomerular filtration rate (eGFR) < 30 mL/min/1.73m2 • Recognizes that a pacemaker is a contraindication to an MRI • Recognizes the risk of contrast-induced nephropathy is increased in patients with chronic kidney disease • Recognizes the need to discontinue Metformin 48 hours prior to contrast administration • Recognizes that morbid obesity limits the utility of abdominal ultrasound in the evaluation of aortic disease
Level 2 *Uses imaging findings to support differential diagnosis and pre-operative plan for basic vascular procedures* *Describes patient factors that influence the imaging modality*	• Appropriately uses and interprets pulse volume recordings waveforms to assess level of vascular disease • Identifies locality and plaque characteristics of a vascular lesions on CT angiography, MR angiography, and angiography • Alters the imaging modality based on the presence of chronic kidney disease
Level 3 *Uses imaging findings to support differential diagnosis and pre-operative plan for intermediate vascular procedures* *Uses complementary information from varying imaging studies*	• Uses three-dimensional CT angiography to create centerline measurements for endovascular aortic repair and thoracic endovascular aortic repair • Selects endografts for endovascular aortic repair and thoracic endovascular aortic repair based on three-dimensional CT angiography centerline measurements
Level 4 *Uses imaging findings to support differential diagnosis, pre-operative plan, and intra-operative decision making for advanced vascular procedures* *Independently uses multidimensional imaging (e.g., 3-D computed tomography angiography [CTA]) and identifies abnormal findings*	• Selects the proper imaging modalities and sequencing based on patient comorbidities, type of vascular pathology, site of care, and urgency of the condition • Discriminates findings on CT angiography that increase the urgency of treatment • Uses three-dimensional CT angiography for case planning of fenestrated endovascular aortic aneurysm repair and iliac branched endografting operations • Uses CT angiography imaging of carotid arteries to choose between carotid endarterectomy versus carotid artery stenting versus transcarotid artery revascularization • Uses intravascular ultrasound for appropriate indications
Level 5 *Implements innovative imaging technology to enhance the care of the patient*	• Works with vascular sonographers to establish a new template/protocol for imaging rare disease conditions • Reformats on 3D reconstruction imaging software (TeraRecon)

Teaches imaging interpretation of multiple modalities	• Consistently uses and understands fusion-type imaging intraoperatively
Assessment Models or Tools	• Assessment of vascular laboratory interpretations • Direct observation • Multisource feedback • Simulation • Registered Physician in Vascular Interpretation (RPVI) certification • VSCORE
Curriculum Mapping	•
Notes or Resources	• Zierler RE, Jordan WD, Lal BK, et al. The Society for Vascular Surgery practice guidelines on follow-up after vascular surgery arterial procedures. *Journal of Vascular Surgery*. 2018;68(1):P256-284. https://www.jvascsurg.org/article/S0741-5214(18)30896-6/fulltext. 2020. • Chung J. Advanced Vascular Imaging for Lower Extremity Peripheral Artery Disease. UpToDate website. https://www.uptodate.com/contents/advanced-vascular-imaging-for-lower-extremity-peripheral-artery-disease. 2020. • Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913.

Medical Knowledge 1: Procedural Rationale (Open Surgical Procedures) **Overall Intent:** To review the pertinent information about a patient (including clinical presentation, physical examination, and diagnostic imaging studies) and to develop a treatment strategy, including medical management endovascular treatment options and open surgical operations	
Milestones	**Examples**
Level 1 *Identifies the need for intervention over medical management*	• Demonstrates awareness for the need of operative intervention/endovascular intervention over medical management alone • Takes into account disease-specific processes and patient demographics and comorbidities when selecting appropriate management
Level 2 *Synthesizes clinical data to choose an open surgical procedure versus endovascular intervention*	• Uses patient-specific information and evidence-based criteria for choosing an open operation over an endovascular intervention • Discusses various surgical options with a younger patient with abdominal aortic aneurysm
Level 3 *Develops a specific operative plan for the current clinical situation, understanding alternative surgical options*	• Demonstrates a thorough understanding of all the operative options, and rationalizes choice for a patient presenting with high grade asymptomatic carotid artery stenosis
Level 4 *Adapts management plan for changing clinical situation*	• Modifies treatment plans according to evolving clinical situation, such as a patient receiving open thrombectomy for acute limb ischemia who does not respond to initial therapy
Level 5 *Develops new guidelines or innovative applications*	• Contributes to evolving evidence around appropriateness of care
Assessment Models or Tools	• In-training examination • Medical record (chart) audit • VSCORE
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913.

Medical Knowledge 2: Procedural Rationale (Endovascular Interventions) **Overall Intent:** To review the pertinent information about a patient (including clinical presentation, physical examination and diagnostic imaging studies) and to develop a treatment strategy, including medical management endovascular treatment options and open surgical operations	
Milestones	**Examples**
Level 1 *Identifies the need for intervention over medical management*	• Demonstrates awareness for the need of operative intervention/endovascular intervention over medical management alone • Considers disease-specific processes and patient demographics and comorbidities when selecting appropriate management
Level 2 *Synthesizes clinical data to choose an endovascular intervention versus open surgical procedure*	• Uses patient-specific information and evidence-based criteria for choosing an endovascular intervention over an open operation • Discusses endovascular options with an elderly patient with abdominal aortic aneurysm
Level 3 *Develops a specific endovascular plan for the current clinical situation, understanding device instructions for use (IFU) and limitations*	• Demonstrates a thorough understanding of all the endovascular options and rationalizes choice for a specific intervention plan • Demonstrates a thorough understanding of all the operative options, and rationalizes endovascular choice for a patient presenting with high grade asymptomatic focal internal carotid artery stenosis (e.g., radiation-induced lesions, recurrent stenosis)
Level 4 *Adapts management plan for changing clinical situation and understands alternative or off label endovascular options*	• Demonstrates ability to modify treatment plans according to evolving clinical situation, such as a patient receiving lysis for acute limb ischemia who does not respond to initial therapy
Level 5 *Develops new guidelines or innovative applications*	• Contributes to evolving evidence around appropriateness of care
Assessment Models or Tools	• In-training examination • Medical record (chart) audit • VSCORE
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131.

Medical Knowledge 3: Procedural Understanding, including Anatomy (Open Surgical Procedures) **Overall Intent:** To ensure adequate knowledge to safely perform open surgical procedures, including the identifying required equipment, knowing procedural anatomy, and understanding key procedural steps and ways to avoid complications	
Milestones	**Examples**
Level 1 *Identifies the types of procedures for a patient's pathology* *Identifies appropriate procedure*	• Names (or broadly describes) the open surgical procedure that can treat the disease process in question, such as need for hemodialysis access
Level 2 *Describes procedural sequence and equipment needs, and understands critical decision points of basic procedures*	• Articulates individual steps of the procedure (e.g., amputations), and identifies critical portions of the procedure that are most technically challenging, including key anatomic exposures and steps with the highest risk of complication
Level 3 *Describes procedural sequence and equipment needs, and understands critical decision points of intermediate procedures*	• Describes steps involved in each procedure (e.g., exposure of popliteal artery) and supports the treatment decision using available literature
Level 4 *Describes procedural sequence and equipment needs, and understands critical decision points of advanced procedures*	• Describes steps involved in a procedure, identifies potential pitfalls, and describes techniques to deal with potential complications like open aortic exposure
Level 5 *Describes or develops an innovative approach in peer-reviewed literature*	• Develops a novel technique or revision of a standard technique that more efficiently performs the procedure
Assessment Models or Tools	• Audit of operative reports • Direct observation • In-training examination • Simulation • VSCORE
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Chaikof EL, Cambria RP. *Atlas of Vascular Surgery and Endovascular Therapy*: *Anatomy and Technique*. 1st ed. Philadelphia, PA: Elsevier; 2014. ISBN:978-1416068419. • Dalman R. *Operative Techniques in Vascular Surgery.* 1st ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451190205. • Wind GG, Valentine RJ. *Anatomic Exposures in Vascular Surgery.* 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2013. ISBN:978-1451184723.

Medical Knowledge 4: Procedural Understanding, including Anatomy (Endovascular Procedures) **Overall Intent:** To ensure adequate knowledge to safely perform endovascular procedures, including identifying and using required equipment, knowing procedural anatomy, and understanding key procedural steps and ways to avoid complications	
Milestones	**Examples**
Level 1 *Identifies the types of procedures for a patient's pathology*	• Identifies and broadly describes an endovascular procedure appropriate for treating the disease process in question, such as an isolated superficial femoral artery (SFA) lesion or hemodialysis for vein stenosis • Suggests fistulogram for the diagnosis of outflow stenosis in an arteriovenous fistula
Level 2 *Describes procedural sequence and understands critical decision points of basic procedures*	• Articulates the individual steps in a procedure and identifies critical portions of procedures that are most technically challenging, including understanding different wires, catheters, and sheaths and their use
Level 3 *Describes procedural sequence and equipment needs, and understands critical decision points of intermediate procedures*	• Describes steps in a procedure and uses evidence-based rationale for decisions • Discusses the steps involved in performance of carotid artery stenting
Level 4 *Describes procedural sequence and equipment needs, and understands critical decision points of advanced procedures*	• Describes steps of endovascular aneurysm repair including decisions between percutaneous access versus open access, identifying potential pitfalls and techniques to deal with potential complications
Level 5 *Describes or develops an innovative approach in peer-reviewed literature*	• Develops novel techniques or revisions to standard technique that improve efficiency
Assessment Models or Tools	• Audit of operative dictations • Direct observation • In-training exam • Simulation • VSCORE
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913. • Schneider P. *Endovascular Skills: Guidewire and Catheter Skills for Endovascular Surgery*. 4th ed. Boca Raton, FL: CRC Press; 2019. ISBN:9780429156304. • Chaikof EL, Cambria RP. *Atlas of Vascular Surgery and Endovascular Therapy*: *Anatomy and Technique*. 1st ed. Philadelphia, PA: Elsevier; 2014. ISBN:978-1416068419. • Dalman R. *Operative Techniques in Vascular Surgery.* 1st ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451190205.

Medical Knowledge 5: Intra-Operative Crisis Management **Overall Intent:** To safely and efficiently manage emergent and non-emergent changes or conditions encountered unexpectantly during the conduct of open, endovascular, or hybrid vascular procedures	
Milestones	**Examples**
Level 1 *Describes potential crises during vascular procedures*	• Lists common problems that occur intra-operatively (e.g., no thrill after a fistula, no pulse after a bypass, absent filling of a renal or hypogastric artery after endovascular aortic repair, bradycardia during carotid procedure)
Level 2 *Describes intra-operative findings associated with a crisis*	• Begins to describe intra-operative prophylactic maneuvers such as opening bypass hood when there is a poor pulse in the graft or distally • Begins to describe intra-operative maneuvers when there is an immediately occluded stent or change in distal runoff
Level 3 *Describes appropriate response to a crisis, including imaging and possible interventions*	• Manages bleeding control and anastomosis revision actively intra-operatively • Communicates effectively with anesthesia and/or nursing during cardiopulmonary compromise during carotid or other surgery, or with regards to titration of medications for conscious sedation • Actively manages changes intra-operatively through further percutaneous transluminal angioplasty/stenting and use of intra-operative drugs such as nitroglycerin or tissue plasminogen activator
Level 4 *Anticipates patient-specific risk for crisis and describes appropriate treatment algorithm and potential outcomes, including conversion to an alternate procedure*	• Manages unplanned need for alternate modalities to safely complete the planned procedure such as balloon control via percutaneous up-and-over approach, intra-operative carotid angiogram/duplex, alternate access sites, etc. • Recognizes and articulates the need for immediate or delayed open conversion for endovascular cases, endovascular conversion for open surgery, or hybrid solutions
Level 5 *Describes, develops, or publishes an innovative approach or otherwise impacts patient care, delivery, or quality*	• Develops new technique or spearheads development of protocol for intra-operative complication recognition and treatment
Assessment Models or Tools	• Assessment of case-based discussion • Assessment of morbidity and mortality (M and M) conference presentation • Direct observation • Multisource feedback • Oral or written self-reflection • Simulation
Curriculum Mapping	•
Notes or Resources	• Sidawy AN, Perler BA. *Rutherford's Vascular Surgery and Endovascular Therapy*. 9th ed. Philadelphia, PA: Elsevier; 2018. ISBN: 978-0323427913.

	• Upchurch Jr. GR, Henke PK. *Clinical Scenarios in Vascular Surgery*. 2nd ed. Philadelphia, PA: Wolters Kluwer; 2015. ISBN:978-1451192131.

Systems-Based Practice 1: Patient Safety **Overall Intent:** To analyze and manage of patient safety events, including relevant communication with patients, families, and health care professionals	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of common patient safety events* *Demonstrates knowledge of how to report patient safety events*	• Is aware that a reaction to contrast is a safety event and knows where and how to report • Is aware that the administration of a wrong dose of medication is a patient safety event • Discusses how to report errors or patient safety event in the hospital and the clinic
Level 2 *Identifies system factors that lead to patient safety events* *Reports patient safety events through institutional reporting systems (simulated or actual)*	• Identifies that poor communication and poor patient hand-offs contribute to patient safety events • Identifies and reports a patient safety issue (real or simulated), along with system factors contributing to that issue
Level 3 *Participates in analysis of patient safety events (simulated or actual)* *Participates in disclosure of patient safety events to patients and their families (simulated or actual)*	• Participates in departmental M and M conferences • Participates in a root cause analysis group • Discloses adverse event, such as wrong medication administered, to a patient or family with supervising physician present
Level 4 *Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)* *Discloses patient safety events to patients and their families (simulated or actual)*	• Collaborates with a team to analyze a patient safety event, develops, and implements an action plan to prevent future contrast reactions • Competently communicates with patients/families about a patient's adverse event, such as a transfusion reaction
Level 5 *Actively engages teams and processes to modify systems to prevent patient safety events* *Role models or mentors others in the disclosure of patient safety events*	• Competently assumes a leadership or committee role at the departmental or institutional level for patient safety, possibly even being the person to initiate action or call attention to the need for action
Assessment Models or Tools	• Direct observation • E-module multiple choice tests • Medical record (chart) audit • Multisource feedback

	• Reflection • Simulation
Curriculum Mapping	•
Notes or Resources	• Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2020. • Disch J, Kilo CM, Passiment M, Wagner R, Weiss KB; National Collaborative for Improving the Clinical Learning Environment. *The Role of Clinical Learning Environments in Preparing New Clinicians to Engage in Patient Safety*. Chicago, IL: ACGME; 2017. • Institutional reporting guidelines

Systems-Based Practice 2: Quality Improvement (QI) **Overall Intent:** To demonstrate the skills necessary to conduct a QI project	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of basic quality metrics and quality improvement methodologies*	• Defines "quality" using the six core aims of the Institute of Medicine (now the National Academy of Medicine) (i.e., safe, timely, efficient, effective, equitable, patient-centered) • Knows that quality improvement methodologies include root cause analysis • Defines and describes the Plan Do Study Act (PDSA) cycle for continuous process improvement • Describes the difference between process and outcome metrics • Describes the difference between registry and claims data
Level 2 *Describes local quality improvement initiatives (e.g., infection rate, smoking cessation)*	• Is aware of institutional QI initiatives including handwashing initiatives and time-outs • Identifies gaps in the quality of care delivery, such as discharge delays, overutilization of routine lab orders, etc.
Level 3 *Participates in local quality improvement initiatives*	• Participates in hospital or departmental QI committee • Participates in a QI project, but may not have yet designed a QI project
Level 4 *Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project*	• Works with department QI committee to analyze data from handwashing project and proposes strategies to improve compliance
Level 5 *Creates, implements, and assesses quality improvement initiatives at the institutional or community level*	• Competently assumes a leadership role at the departmental or institutional level for patient safety and/or QI initiatives, possibly even being the person to initiate action or call attention to the need for action • Obtains advanced QI training, such as Lean Six Sigma
Assessment Models or Tools	• Direct observation • E-module multiple choice tests • Multisource feedback • Reflection • Simulation
Curriculum Mapping	•
Notes or Resources	• Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2020. • American College of Surgeons. The Quality In-Training Initiative: An ACS NSQIP Collaborative. https://qiti.acsnsqip.org/ACS_NSQIP_2017_QITI_Curriculum.pdf. 2020.

Systems-Based Practice 3: System Navigation for Patient-Centered Care **Overall Intent:** To effectively navigate the health care system, including the interdisciplinary team and other care providers, to ensure high-quality patient outcomes	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of care coordination* *Identifies key elements for safe and effective transitions of care and hand-offs*	• Identifies the members of the interprofessional team and describes their roles but is not yet routinely using team members or accessing resources • Lists the essential components of an effective hand-off of care
Level 2 *Coordinates multidisciplinary care of patients in routine clinical situations effectively using the roles of the interprofessional team members* *Performs safe and effective transitions of care/hand-offs in routine clinical situations*	• Contacts interprofessional team members, such as social workers and consultants, but requires supervision to ensure all necessary referrals are made and resource needs are arranged • Hands off care for intensive care unit (ICU) patients using systems approach
Level 3 *Coordinates multidisciplinary care of patients in complex clinical situations, including those with barriers to access, effectively using the roles of the interprofessional team members* *Performs safe and effective transitions of care/hand-offs in complex clinical situations*	• After repair of a ruptured abdominal aortic aneurysm, the resident arranges for a nutritionist, occupational therapy/physical therapy, and follow-up appointments • Leads the team in transition of care and hand-offs of care for during trauma and emergency surgery
Level 4 *Role models effective coordination of patient-centered care among different disciplines and specialties* *Role models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems, including outpatient settings*	• Directs post-hospital care of an undomiciled person with complex surgical illness such as post stroke • Proactively ensures transitions of care elements are completed for a discharged patient, such as calling the primary care provider to get international normalized ratio checks, • Provides efficient handoff of care to the ICU team at the end of a rapid response event • Coordinates and prioritizes consultant input for a new high-risk diagnosis (such as malignancy) to ensure the patient gets appropriate follow up
Level 5 *Analyzes the process of care coordination and leads in the design and implementation of improvements*	• Takes a leadership or committee role in designing and implementing changes to improve the care coordination process

Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes	• Creates innovative tools for safe transitions of care
Assessment Models or Tools	• Direct observation • Medical record (chart) audit • Multisource feedback • Objective structured clinical examination (OSCE) • Review of sign-out tools, use and review of checklists
Curriculum Mapping	•
Notes or Resources	• Kaplan KJ. In pursuit of patient-centered care. http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. 2020. • Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan J, Gonzalo JD. *AMA Education Consortium: Health Systems Science*. Elsevier; 2016.

Systems-Based Practice 4: Population Health **Overall Intent:** To adapt care to a specific patient population to optimize high-quality patient outcomes	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of population and community health needs and disparities*	• Knows that patients without insurance are less likely to receive appropriate preventive care • Knows that an undomiciled patient is less likely to receive follow-up care
Level 2 *Identifies specific population and community health needs and inequities for their local population*	• Knows which patients are at high risk for specific health outcomes related to health literacy concerns, cost, LGBTQ status, drug use, etc. • Knows which patients are at high risk for specific health outcomes related to immunosuppression or connective tissue disorders
Level 3 *Uses local resources effectively to meet the needs of a patient population and community*	• Appreciates the need for and uses clinic or local resources, such as the social worker/health navigator, to ensure patients with low literacy understand how to schedule a procedure
Level 4 *Participates in changing and adapting practice to provide for the needs of specific populations*	• Identifies patient populations at high risk for poor post-operative outcomes due to health disparities and implements strategies to improve care • Works with a care coordinator to have a plan for an inpatient to avoid readmission • Develops multilingual patient education materials
Level 5 *Leads innovations, publishes peer-reviewed paper, or advocates for populations and communities with health care inequities*	• Works with local outreach program to develop a screening program for peripheral arterial disease
Assessment Models or Tools	• Direct observation • Medical record (chart) audit • Multisource feedback • OSCE • Review of sign-out tools, use and review of checklists
Curriculum Mapping	•
Notes or Resources	• CDC. Population Health Training in Place Program (PH-TIPP). https://www.cdc.gov/pophealthtraining/whatis.html. 2020. • Kaplan KJ. In pursuit of patient-centered care. http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns. 2020. • Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan J, Gonzalo JD. *AMA Education Consortium: Health Systems Science*. Elsevier; 2016.

Systems-Based Practice 5: Physician Role in Health Care Systems **Overall Intent:** To understand the physician's role in the complex health care system and how to optimize the system to improve patient care and the performance of the health system	
Milestones	**Examples**
Level 1 *Identifies key components of the complex health care system (e.g., hospital, skilled nursing facility, finance, personnel, technology)* *Describes basic health payment systems (e.g., government, private, public, uninsured care) and practice models*	• Articulates differences between skilled nursing and long-term care facilities • Documents justification for continued inpatient status versus observation status • Understands the impact of health plan coverage on prescription drugs for individual patients
Level 2 *Describes how components of a complex health care system are interrelated, and understands how this impacts patient care* *Delivers care with consideration of each patient's payment model (e.g., insurance type)* *Identifies the need for timely documentation to support billing*	• Explains that improving patient satisfaction impacts patient adherence and payment to the health system • Understands readmission criteria, anticipates and mitigates patient readmission • Takes into consideration patient's prescription drug coverage when choosing a statin for treatment of hyperlipidemia • Recognizes that appropriate documentation can influence the severity of illness determination upon discharge • Identifies that notes must meet coding requirements
Level 3 *Discusses how individual practice affects the broader system (e.g., length of stay, readmission rates, clinical efficiency)* *Engages with patients in shared decision making, informed by each patient's payment models* *Demonstrates use of information technology required for medical practice*	• Ensures that a patient who is post-operative has a scheduled follow-up appointment and appropriate outpatient services at discharge to reduce risk of readmission • Discusses risks and benefits of pursuing coumadin versus direct oral anticoagulant for anticoagulant therapy when a patient has a high-out-of pocket deductible • Understands the core elements of employment contract negotiation
Level 4 *Manages various components of the complex health care system to provide efficient and effective patient care and transitions of care*	• Prior to discharge to a skilled nursing facility, ensures proper documentation of level of care in the hospital

Advocates for patient care needs (e.g., community resources, patient assistance resources) with consideration of the limitations of each patient's payment model *Demonstrates core administrative knowledge needed for transition to practice*	• Works collaboratively to improve patient assistance resources for a patient with a recent amputation and limited resources • Proactively compiles procedure log in anticipation of applying for hospital privileges
Level 5 *Advocates for or leads systems change that enhances high-value, efficient and effective patient care and transitions of care* *Participates in local, regional, or national health policy advocacy activities* *Proposes changes to patient care or billing practices to improve compliance and reimbursement*	• Works with community or professional organizations to advocate for no smoking ordinances • Testifies in front of the state Senate regarding health policy
Assessment Models or Tools	• Direct observation • Medical record (chart) audit • Patient satisfaction data
Curriculum Mapping	•
Notes or Resources	• Agency for Healthcare Research and Quality (AHRQ). The Challenges of Measuring Physician Quality. https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/challenges.html. 2020. • AHRQ. Major Physician Measurement Sets. https://www.ahrq.gov/talkingquality/measures/setting/physician/measurement-sets.html. 2020. • The Kaiser Family Foundation. www.kff.org. 2020. • The Kaiser Family Foundation. Topic: Health Reform. https://www.kff.org/topic/health-reform/. 2020. • Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities from a National Academy of Medicine Initiative. *NAM Perspectives*. Discussion Paper, National Academy of Medicine, Washington, DC. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. 2020. • The Commonwealth Fund. Health System Data Center. https://datacenter.commonwealthfund.org/#ind=1/sc=1. 2020.

	• SVS. Vascular Quality Initiative. https://vascular.org/research-quality/vascular-quality-initiative. 2020. • Choosing Wisely. Clinician Lists. https://www.choosingwisely.org/clinician-lists/. 2020.

Systems-Based Practice 6: Radiation Safety **Overall Intent:** To advocate for radiation safety awareness	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the mechanisms of radiation injury and the ALARA ("as low as reasonably achievable") concept*	• Describes fundamental concepts in radiation biology addressing the mechanism of injury at different radiation exposures
Wears lead apron and dosimeter at all times	• Wears lead apron and ensures others in the room also wears one
Level 2 *Applies principles of ALARA in daily practice*	• Readily accesses online resources to determine a CT of the head average dose information
Uses fluoroscopy techniques that decrease exposure, with guidance	• Uses screen capture instead of spot radiograph for documentation of central venous catheter tip position, when reminded
Uses radiation protection devices, including shielding, as appropriate, with guidance	• Increases the distance between the patient and the radiation source and lowers the image detector closer to the patient, when reminded • Makes sure the operator hand/arm is not present in the imaging when performing endovascular access and interventions • Brings overhead shield in-between patient and operator
Level 3 *Accesses resources to determine exam-specific radiation dose information*	• Considers alternative imaging modalities to reduce radiation exposure • Independently uses screen capture instead of spot radiograph for documentation of central venous catheter tip position • Independently lowers the image detector closer to the patient • Independently brings overhead shield in-between patient and operator
Independently uses radiation protection devices, including shielding, as appropriate	• Can execute the steps of a diagnostic angiogram of the lower extremity with limited fluoroscopy and radiation (e.g., demonstrates smooth handling of the C-arm/fixed image intensifier with appropriate angles needed for the specific image) • Actively participates in personal monitoring of radiation doses
Level 4 *Communicates the relative risk and benefits of exam-specific radiation exposure to patients and practitioners*	• Counsels patients of the risks of skin effects relative to dose received • Counsels patients of the risk of cumulative radiation exposure from all sources
Counsels colleagues and allied health staff regarding radiation exposure	• Instructs more junior residents and other members of the operative team in radiation dose reduction techniques • Answers questions from colleagues regarding risk of cataracts from radiation exposure

Level 5 *Creates, implements, and assesses radiation safety initiatives at the institutional level* *Participates in radiation safety education and research*	• Begins a radiation safety initiative with the Radiation Safety Committee
Assessment Models or Tools	• Direct observation • Documentation of QI or radiation safety project processes or outcome • VSCORE
Curriculum Mapping	•
Notes or Resources	• American College of Radiology. ACR Appropriateness Criteria. https://www.acr.org/Clinical-Resources/ACR-Appropriateness-Criteria. 2020. • Image Gently. Pediatric Radiology and Imaging. https://www.imagegently.org. 2020. • ImageWisely. Resources for Patients and Referring Practitioners. https://www.imagewisely.org/Imaging-Modalities/Patients-Referring-Practitioners. 2020. • American College of Radiology. Radiology Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety. 2020. • Radiological Society of North America. Physics Modules. https://www.rsna.org/en/education/trainee-resources/physics-modules. 2020. • American College of Radiology. Radiation Safety. https://www.acr.org/Clinical-Resources/Radiology-Safety/Radiation-Safety. 2020.

Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice **Overall Intent:** To incorporate evidence and patient values into clinical practice	
Milestones	**Examples**
Level 1 *Demonstrates effective access and use of available evidence to guide routine patient care*	• Recognizes that there are ongoing and past clinical trials comparing management for a variety of vascular pathologies
Level 2 *Articulates clinical questions and elicits patient preferences and values to guide evidence-based care*	• When discussing alternatives with a patient, articulates the reasons that endovascular aortic repair is preferred over open repair for most patients based on available clinical trial data
Level 3 *Identifies and applies the best available evidence and integrates data to the care of complex patients*	• Recognizes patient factors and integrates clinical trial data into decision making for most complicated patients
Level 4 *Critically appraises and applies evidence, even in the face of uncertainty and conflicting evidence, to guide care tailored to the individual patient*	• Uses the Society for Vascular Surgery and other societal clinical practice guidelines to determine the most appropriate treatment in each patient • Identifies patients who do not fit standard treatment algorithms based on clinical trial data and proposes alternative treatment approaches
Level 5 *Coaches others to critically appraise and apply evidence for complex patients, and/or participates in the development of peer-reviewed literature or guidelines*	• Proposes a clinical study to identify the best practice in patients for whom prior clinical trials do not apply • Participates in the development of new treatment guidelines • Identifies discrepancies in different societal guidelines and understands considerations regarding data quality, patient samples, and other factors that may produce disparate recommendations; identifies means to synthesize the data as it applies clinically at the bedside
Assessment Models or Tools	• Case conferences • Direct observation • Oral or written examinations
Curriculum Mapping	•
Notes or Resources	• National Institutes of Health. Write Your Application. https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm. 2020. • U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2020. • Institutional IRB guidelines • Various journal submission guidelines

Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Personal Growth **Overall Intent:** To become a lifelong learner and integrate outcomes into practice and develop clear objectives and goals for improvement in some form of a learning plan	
Milestones	**Examples**
Level 1 *Establishes goals for personal and professional development*	• Identifies need to improve through self-reflection • Seeks ways to improve
Level 2 *Identifies opportunities for performance improvement; designs a learning plan*	• Recognizes technical skills deficiencies and schedules time in the skills lab • Reviews VSITE score and creates a study plan for lowest scoring areas
Level 3 *Integrates performance feedback and practice data to develop and implement a learning plan*	• After receiving feedback from multiple faculty members and more senior residents, attends skills lab to improve identified technical skills deficits • Meets with a mentor on an ongoing basis to maintain preparation for VSITE • After receiving multisource feedback from patients and peers, identifies the need to improve communication skills and develops a plan with assistance of mentor
Level 4 *Revises learning plan based on performance data*	• Changes previous study plan if VSITE score did not improve • Seeks a new area for learning if previous plan is completed successfully, such as use of computer simulation of endografting for complex aortic anatomy or improving cross cultural communication • Improves open and endovascular technical skills but continues to practice additional techniques based on self-reflection and feedback
Level 5 *Coaches others in the design and implementation of learning plans*	• Leads sessions and coaches residents who are struggling on study techniques to improve VSITE score • Independently identifies and coaches residents struggling with technical skills
Assessment Models or Tools	• Direct observation • Mentor/coach evaluation of learning plan • Multisource feedback
Curriculum Mapping	•
Notes or Resources	• Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. *Acad Pediatr.* 2014;14: S38-S54. https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/fulltext. 2020. • Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. *Academic Medicine.* 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians__Lifelong.21.aspx. 2020. • Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. *Academic Medicine*. 2013;88(10):1558-1563.

	https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents__Written_Learning_Goals_and.39.aspx. 2020. • Bassot B. *The Reflective Practice Guide: An Interdisciplinary Approach to Critical Reflection*. New York, NY: Routledge; 2015. ISBN:978-1138784314.

Professionalism 1: Professional Behavior **Overall Intent:** To recognize and address lapses in professional behavior, demonstrates professional behaviors, and uses appropriate resources for managing professional dilemmas	
Milestones	**Examples**
Level 1 *Demonstrates insight into professional behavior in routine situations and takes responsibility for own lapses*	• After being late for rounds, takes initiative to discuss improvement plan with a more senior resident and adjusts own schedule to prevent tardiness
Level 2 *Identifies and describes potential triggers for professionalism lapses and when to report lapses in professionalism*	• Understands that being tired can cause a lapse in professionalism • Understands that being late to sign-out has adverse effect on patient care and on professional relationships
Level 3 *Demonstrates professional behavior in complex or stressful situations and when to seek help to resolve complex ethical situation*	• Appropriately responds to a distraught family member following an unsuccessful resuscitation attempt of a relative
Level 4 *Recognizes situations that may trigger professionalism lapses and intervenes to prevent lapses in oneself and others*	• Actively considers the perspective of patient who has been waiting an excessively long time to be seen • Coaches a more junior resident on how to approach the patient to diffuse the situation
Level 5 *Coaches others when their behavior fails to meet professional expectations*	• Discusses excessive tardiness with a more junior resident and develops a corrective improvement plan
Assessment Models or Tools	• Direct observation • Global evaluation • Multisource feedback • Oral or written self-reflection • Simulation
Curriculum Mapping	•
Notes or Resources	• American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2020. • ACS. Code of Professional Conduct. https://www.facs.org/about-acs/statements/stonprin#code. 2020. • Ferreres AR, Angelos P, Singer EA, Blair PG. *Ethical Issues in Surgical Care*. American College of Surgeons. https://www.facs.org/Education/Division-of-Education/Publications/Ethical-Issues-in-Surgical-Care. 2020. • SCORE. Modules. https://www.surgicalcore.org/. 2020. • American Board of Internal Medicine, ACP-ASIM Foundation, European Federation of Internal Medicine. Medical professionalism in the new millennium: a physician charter. *Ann Intern Med*. 2002;136:243-246. http://abimfoundation.org/wp-

	content/uploads/2015/12/Medical-Professionalism-in-the-New-Millenium-A-Physician-Charter.pdf. 2020. • Domen RE, Johnson K, Conran RM, et al. Professionalism in pathology: a case-based approach as a potential education tool. *Arch Pathol Lab Med*. 2017;141:215-219. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0217-CP?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. • Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. New York, NY: McGraw-Hill Education; 2014. • Bynny RL, Paauw DS, Papadakis MA, Pfeil S. *Medical Professionalism. Best Practices: Professionalism in the Modern Era*. Menlo Park, CA: Alpha Omega Alpha Medical Society; 2017. ISBN: 978-1-5323-6516-4

Professionalism 2: Ethical Principles **Overall Intent:** To demonstrates ethical behaviors and use appropriate resources for managing ethical dilemmas	
Milestones	**Examples**
Level 1 *Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources, and related topics*	• Articulates how the principle of "do no harm" applies to a patient who may not need a central line even though the training opportunity exists • Maintains the privacy and confidentiality of patient information
Level 2 *Applies ethical principles to straightforward situations*	• Identifies and applies ethical principles involved in informed consent when the resident is unclear of all the risks • Applies a comprehensive approach to clinical ethical judgement and understands that not every incremental reduction of mortality is worth the increased morbidity, lost functional status, pain, and diminished quality of life
Level 3 *Applies ethical principles to complex situations*	• Offers treatment options for a terminally ill patient, free of bias, while recognizing one's own limitations and consistently honoring the patient's wishes • Recognizes the need to engage both senior members of the treatment team and the patient's family in helping patients make informed decisions in complex situations
Level 4 *Resolves ethical dilemmas using appropriate resources (e.g., ethics consultations, literature review, risk management/legal consultation)*	• Recognizes and uses ethics consults, literature, and risk-management/legal counsel to resolve complex ethical dilemmas
Level 5 *Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution*	• Engages stakeholders to address system-wide bias or inappropriate conduct from system leaders
Assessment Models or Tools	• Direct observation • Global evaluation • Multisource feedback • Oral or written self-reflection • Simulation
Curriculum Mapping	•
Notes or Resources	• AMA. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2020. • ACS. Code of Professional Conduct. https://www.facs.org/about-acs/statements/stonprin#code. 2020. • Code of conduct from institutional manual

	• American Board of Internal Medicine, ACP-ASIM Foundation, European Federation of Internal Medicine. Medical professionalism in the new millennium: a physician charter. *Ann Intern Med*. 2002;136:243-246. http://abimfoundation.org/wp-content/uploads/2015/12/Medical-Professionalism-in-the-New-Millenium-A-Physician-Charter.pdf. 2020. • Domen RE, Johnson K, Conran RM, et al. Professionalism in pathology: a case-based approach as a potential education tool. *Arch Pathol Lab Med*. 2017;141:215-219. https://www.archivesofpathology.org/doi/10.5858/arpa.2016-0217-CP?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. 2020. • Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. New York, NY: McGraw-Hill Education; 2014. • Bynny RL, Paauw DS, Papadakis MA, Pfeil S. *Medical Professionalism. Best Practices: Professionalism in the Modern Era*. Menlo Park, CA: Alpha Omega Alpha Medical Society; 2017. ISBN: 978-1-5323-6516-4 • SVS. Code of Ethics. http://vascular.org/about-svs/policies/code-ethics. 2020. • Jones JW, McCullough LB. Obligations and frustrations with high-risk patients: Ethics of physicians' evaluations. *J Vasc Surg*. 2015;61(2):533-534. https://www.sciencedirect.com/science/article/pii/S0741521414022277. 2020.

Professionalism 3: Accountability/Conscientiousness **Overall Intent:** To take responsibility for one's own actions and the impact on patients and other members of the health care team	
Milestones	**Examples**
Level 1 *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations*	• Completes administrative tasks, documents safety modules, procedure review, and licensing requirements by specified due date • Before going out of town, completes tasks in anticipation of lack of computer access while traveling
Level 2 *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations*	• Notifies attending of multiple competing demands on call, appropriately triages tasks, and asks for assistance from other residents or faculty members as needed • In preparation for being out of the office, arranges coverage for assigned clinical tasks on patients and ensures appropriate continuity of care
Level 3 *Takes responsibility for failures, identifies potential contributing factors, and describes strategies for ensuring timely task completion in the future*	• Responds promptly to reminders from program administrator to complete work hour logs • Timely attendance at conferences • Completes end-of-rotation evaluations
Level 4 *Recognizes situations that may impact others' ability to complete tasks and responsibilities in a timely manner, and proactively implements strategies to ensure the needs of the patient and team are met*	• Takes responsibility for inadvertently omitting key patient information during sign-out and professionally discusses with the patient, family and interprofessional team
Level 5 *Takes ownership of system outcomes and works toward system-level changes*	• Sets up a meeting with the nurse manager to streamline patient discharges and leads team to find solutions to the problem
Assessment Models or Tools	• Compliance with deadlines and timelines • Direct observation • Global evaluations • Multisource feedback • Self-evaluations and reflective tools • Simulation
Curriculum Mapping	•
Notes or Resources	• SVS. Code of Ethics. http://vascular.org/about-svs/policies/code-ethics. 2020. • Code of conduct from fellow/resident institutional manual • Expectations of residency program regarding accountability and professionalism • ACGME Program Requirements for Graduate Medical Education in Vascular Surgery

Professionalism 4: Self-Awareness and Help-Seeking **Overall Intent:** To identify, use, manage, improve, and seek help for personal and professional well-being for self and others	
Milestones	**Examples**
Level 1 *With assistance, recognizes status of personal and professional well-being*	• Acknowledges own response to patient's death • Recognizes the importance of physical well-being
Level 2 *Independently recognizes status of personal and professional well-being*	• Independently identifies and communicates personal impact of surgical complications on well-being • Independently recognizes the importance of ergonomics in the operating room
Level 3 *With assistance, proposes a plan to optimize personal and professional well-being*	• With the multidisciplinary team, discusses the personal impact of surgical complications and how to manage the stress or guilt associated with the outcome • Practices ergonomic changes to improve well being
Level 4 *Independently develops a plan to optimize personal and professional well being*	• Independently identifies ways to manage personal stress such as having open discussions with colleagues about common stressors • Optimizes operating room environment to promote physical health of others improving ergonomics for team
Level 5 *Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations*	• Assists in organizational efforts to address clinician well-being after patient diagnosis/prognosis/death • Works with multidisciplinary team to develop a feedback framework for learners around family meetings • Develops innovative technique or device that improves surgical ergonomics
Assessment Models or Tools	• Direct observation • Group interview or discussions for team activities • Individual interview • Institutional online training modules • Self-assessment and personal learning plan
Curriculum Mapping	•
Notes or Resources	• This subcompetency is not intended to evaluate a fellow's well-being, but to ensure each fellow has the fundamental knowledge of factors that impact well-being, the mechanisms by which those factors impact well-being, and available resources and tools to improve well-being. • Local resources, including Employee Assistance • Wohlauer M, Coleman DM, Sheahan MG, et al. Physical pain and musculoskeletal discomfort in vascular surgeons. *J Vasc Surg*. 2020;S0741-5214(20)31893-0. https://pubmed.ncbi.nlm.nih.gov/32890720/. 2020.

	• ACGME. “Well-Being Tools and Resources.” https://dl.acgme.org/pages/well-being-tools-resources. Accessed 2022. • Hicks PJ, Schumacher D, Guralnick S, Carraccio C, Burke AE. Domain of competence: personal and professional development. *Acad Pediatr*. 2014;14(2 Suppl):S80-97. https://www.sciencedirect.com/science/article/abs/pii/S187628591300332X. 2020. • National Academy of Medicine. Action Collaborative on Clinician Well-Being and Resilience. https://nam.edu/initiatives/clinician-resilience-and-well-being/. 2020.

Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication **Overall Intent:** To deliberately use language and behaviors to form a therapeutic relationship with a patient and family members; identify communication barriers, including self-reflection on personal biases, and minimize them in the doctor-patient relationship; organize and lead communication around shared decision making	
Milestones	**Examples**
Level 1 *Communicates with patients and their families in an understandable and respectful manner* *Provides timely updates to patients and their families*	• Self-monitors and controls tone, non-verbal cues, and language; asks questions to invite the participation of patients and their families • Accurately communicates own role in the health care system, and identifies common communication barriers (e.g., loss of hearing, language, aphasia) in patient and family encounters • Communicates with patients and patients' families on changing conditions • Provides patients with routine information, such as results of imaging studies and labs obtained earlier in the day
Level 2 *Customizes communication, in the setting of personal biases and barriers (e.g., age, literacy, cognitive disabilities, cultural differences) with patients and their families* *Actively listens to patients and their families to elicit patient preferences and expectations*	• Identifies and adjusts to complex communication barriers (e.g., culture, religious beliefs, health literacy) in patient and family encounters • Leads a discussion about acute pain management with the patient and the family, reassessing the patient's and family's understanding and anxiety
Level 3 *Delivers complex and difficult information to patients and their families* *Uses shared decision making to make a personalized care plan*	• Establishes and maintains a therapeutic relationship with a challenging patient (e.g., angry, non-compliant, substance seeking, mentally challenged) • Attempts to mitigate identified communication barriers, including reflection on implicit biases (e.g., preconceived ideas about patients of certain race or weight) when prompted • Acknowledges uncertainty in a patient's medical complexity and prognosis • Independently engages in shared decision making with the patient and family, including a recommended acute pain management plan to align a patient's unique goals with treatment options
Level 4 *Facilitates difficult discussions specific to patient and patient family's conferences, (e.g., end-of-life, explaining complications, therapeutic uncertainty)* *Effectively negotiates and manages conflict among patients, their families, and the health care team*	• Facilitates family conference when family members disagree about the goals of care • Negotiates care management plan when interventions will be medically ineffective

Level 5 *Coaches others in the facilitation of difficult and crucial conversations* *Coaches others in conflict resolution*	• Mentors/coaches and supports colleagues in self-awareness and reflection to improve therapeutic relationships with patients • Creates a curriculum to teach conflict resolution in family conferences
Assessment Models or Tools	• Direct observation • Kalamazoo Essential Elements Communication Checklist (Adapted) • Mini-clinical evaluation exercise • Multisource feedback (e.g., advanced practice providers, nurses) • Self-assessment including self-reflection exercises • Standardized patients or structured case discussions
Curriculum Mapping	•
Notes or Resources	• Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2020. • Makoul G. Essential elements of communication in medical encounters: the Kalamazoo consensus statement. *Acad Med*. 2001;76(4):390-393. https://journals.lww.com/academicmedicine/Fulltext/2001/04000/Essential_Elements_of_Communication_in_Medical.21.aspx#pdf-link. 2020. • Makoul G. The SEGUE Framework for teaching and assessing communication skills. *Patient Educ Couns*. 2001;45(1):23-34. https://www.sciencedirect.com/science/article/abs/pii/S0738399101001367?via%3Dihub. 2020. • Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2020. • O'Sullivan P, Chao S, Russell M, Levine S, Fabiny A. Development and implementation of an objective structured clinical examination to provide formative feedback on communication and interpersonal skills in geriatric training. *J Am Geriatr Soc.* 2008;56(9):1730-5. https://pubmed.ncbi.nlm.nih.gov/18721223/. 2020. • American Academy of Hospice and Palliative Medicine. Hospice and Palliative Medicine Competencies Project. http://aahpm.org/fellowships/competencies#competencies-toolkit. 2020. • AHRQ. TeamSTEPPS. https://www.ahrq.gov/teamstepps/index.html. 2020. • SCORE. Module Resources. https://www.surgicalcore.org/modules. 2020.

	• American College of Surgeons. Communicating with Patients about Surgical Errors and Adverse Outcomes. https://web4.facs.org/ebusiness/ProductCatalog/product.aspx?ID=229. 2020. • American College of Surgeons. Disclosing Surgical Error Vignettes. https://web4.facs.org/ebusiness/ProductCatalog/product.aspx?ID=157. 2020. • Baile WF, Buckman R, Lenzi R, et al. SPIKES - a six-step protocol for delivering bad news: application to the patient with cancer. *Oncologist*. 2000;5:302-311. https://pubmed.ncbi.nlm.nih.gov/10964998/. 2020. • Dale WA, A surgeon's primer of errors. *JVS.*1990;12(1):99-104. • Jones JW, McCullough LB. Transgression confession: Ethics of medical error disclosure. *JVS*. 2013;58(6):1697-1699. https://www.sciencedirect.com/science/article/pii/S0741521413019356. 2020.

Interpersonal and Communication Skills 2: Interprofessional and Team Communication **Overall Intent:** To effectively communicate with the health care team, including consultants, in both straightforward and complex situations	
Milestones	**Examples**
Level 1 *Uses language that values all members of the health care team* *Open to feedback on performance as a member of the health care team*	• When asking for a cardiology consultation for a patient with Marfan syndrome, respectfully relays the diagnosis and need to assess the aortic root diameter • Receives consult request for a patient with an aortic aneurysm, asks clarifying questions politely, and expresses gratitude for the consult • Acknowledges the contribution of each member of the multidisciplinary team to the patient
Level 2 *Communicates information effectively and concisely with all health care team members* *Solicits feedback on performance as a member of the health care team*	• Communicates diagnostic evaluation recommendations clearly and concisely in an organized and timely manner to all team members on rounds • Communicates with the physical therapist of a patient who underwent toe amputation that it is okay for the patient to be weight bearing as tolerated in an off-loading shoe
Level 3 *Uses active listening to adapt communication style to fit team needs* *Communicates concerns and provides feedback to peers and learners*	• After a consultation has been completed, communicates with the primary care team to verify they have received and understand the recommendations • Participates in closed-loop communication and communicates plan to the rest of the team members
Level 4 *Coordinates recommendations from different members of the health care team to optimize patient care* *Facilitates regular health care team-based feedback in complex situations*	• Initiates a multidisciplinary meeting to develop a shared care plan for a patient with abdominal aortic aneurysm diagnosed during work up for malignancy • Requests and is receptive to feedback regarding plan management and communication style
Level 5 *Role models flexible communication strategies that value input from all health care team members, resolving conflict when needed* *Communicates feedback and constructive criticism to superiors*	• Mediates conflict resolution between different members of the health care team
Assessment Models or Tools	• Direct observation • Global assessment • Medical record (chart) audit • Multisource feedback

	• Simulation
Curriculum Mapping	•
Notes or Resources	• Mills P, Neily J, Dunn E. Teamwork and communication in surgical teams: implications for patient safety. *JACS*. 206;107-112:2008. https://pubmed.ncbi.nlm.nih.gov/18155575/. 2020. • Team training courses • Non-Technical Training Skills for Surgeons (NOTSS). https://www.notss.org. 2020. • Green M, Parrott T, Cook G., Improving your communication skills. *BMJ*. 2012;344:e357. https://www.bmj.com/content/344/bmj.e357. 2020. • Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. *Med Teach*. 2013;35(5):395-403. https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677. 2020. • Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. *Med Teach*. 2019;41(7):1-4. https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499. 2020. • François J. Tool to assess the quality of consultation and referral request letters in family medicine. *Can Fam Physician*. 2011;57(5):574–575. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3093595/. 2020. • Fay D, Mazzone M, Douglas L, Ambuel B. A validated, behavior-based evaluation instrument for family medicine residents. *MedEdPORTAL*. 2007. https://www.mededportal.org/doi/10.15766/mep_2374-8265.622. 2020. • Dehon E, Simpson K, Fowler D, Jones A. Development of the faculty 360. *MedEdPORTAL*. 2015;11:10174. http://doi.org/10.15766/mep_2374-8265.10174. 2020. • Lane JL, Gottlieb RP. Structured clinical observations: a method to teach clinical skills with limited time and financial resources. *Pediatrics*. 2000;105:973-7. https://pubmed.ncbi.nlm.nih.gov/10742358/. 2020. • Braddock CH, Edwards KA, Hasenberg NM, Laidley TL, Levinson W. Informed decision making in outpatient practice: time to get back to basics. *JAMA*. 1999;282:2313-2320. https://pubmed.ncbi.nlm.nih.gov/10612318/. 2020.

Interpersonal and Communication Skills 3: Communication within Health Care Systems **Overall Intent:** To develop skills and behaviors that allows the resident to communicate effectively within the context of a health care system	
Milestones	**Examples**
Level 1 *Accurately records information in the patient record, including appropriate use of documentation templates*	• Fills in all elements of a documentation template with the most up-to-date information available
Level 2 *Appropriately selects form and urgency of communication based on context*	• Appropriately communicates changes in the clinical status of a patient in a timely manner
Level 3 *Demonstrates efficient use of electronic health record (EHR) to communicate with the health care team*	• Creates accurate, original notes that do not contain extraneous information such as verbatim transcriptions of radiology reports, and concisely summarizes the assessment and plan
Level 4 *Integrates and synthesizes all relevant data from outside systems and prior encounters into the EHR*	• Collects information from outside health care systems and then accurately and succinctly incorporates that information into the EHR
Level 5 *Guides departmental or institutional communication around policies and procedures*	• Mentors/coaches colleagues how to improve clinical notes, including terminology, billing compliance, conciseness, and inclusion of all required elements • Creates a policy around Health Insurance Portability and Accountability Act (HIPAA)-compliant electronic communication (e.g., texting)
Assessment Models or Tools	• Chart stimulated recall • Direct observation • Medical record (chart) audit • Multisource feedback
Curriculum Mapping	•
Notes or Resources	• Bierman JA, Hufmeyer KK, Liss DT, Weaver AC, Heiman HL. Promoting responsible electronic documentation: validity evidence for a checklist to assess progress notes in the electronic health record. *Teach Learn Med.* 2017;29(4):420-432. https://pubmed.ncbi.nlm.nih.gov/28497983/. 2020. • U.S. Department of Health & Human Services. Health Information Privacy. https://www.hhs.gov/hipaa/index.html. 2020.

To help programs transition to the new version of the Milestones, the original Milestones 1.0 have been mapped to the new Milestones 2.0. Where the subcompetencies are similar between versions is indicated below. These are not exact matches, but include some of the same elements. Not all subcompetencies map between versions. Inclusion or exclusion of any subcompetency does not change the educational value or impact on curriculum or assessment.

Milestones 1.0	Milestones 2.0
PC1: Patient Data	PC1: Patient Data
PC2: Vascular Medicine	PC2: Medical Management of Vascular Disease
PC3: Peri-operative Care	PC3: Peri-Operative Care
PC4: Longitudinal Care	PC4: Longitudinal Care
PC5: Technical Skills – Procedural Preparation	PC5: Procedural Preparation
PC6: Technical Skills – Open Surgical Skills	PC6: Technical Skills – Open Surgical Skills
PC7: Technical Skills – Endovascular	PC7: Technical Skills – Endovascular
PC8: Vascular Imaging	PC8: Vascular Imaging
MK1: Procedural Rationale – Basic Procedures	MK1: Procedural Rationale (Open Surgical Procedures) MK2: Procedural Rationale (Endovascular Interventions)
MK2: Procedural Anatomy – Basic Procedures	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK3: Procedural Understanding	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK4: Crisis Management – Basic Procedures	MK5: Intraoperative Crisis Management
MK5: Procedural Rationale – Intermediate Procedures	MK1: Procedural Rationale (Open Surgical Procedures) MK2: Procedural Rationale (Endovascular Interventions)
MK6: Procedural Anatomy – Intermediate Procedures	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK7: Procedural Understanding – Intermediate Procedures	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK8: Crisis Management – Intermediate Procedures	MK5: Intra-Operative Crisis Management
MK9: Procedural Rationale – Advanced Procedures	MK1: Procedural Rationale (Open Surgical Procedures)

	MK2: Procedural Rationale (Endovascular Interventions)
MK10: Procedural Anatomy – Advanced Procedures	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK11: Procedural Understanding – Advanced Procedures	MK3: Procedural Understanding, including Anatomy (Open Surgical Procedures) MK4: Procedural Understanding, including Anatomy (Endovascular Procedures)
MK12: Crisis Management – Advanced Procedures	MK5: Intraoperative Crisis Management
SBP1: Radiation Safety	SBP6: Radiation Safety
SBP2: Coordination of Care	SBP3: System Navigation for Patient Centered Care
SBP3: Improvement of Care	SBP1: Patient Safety
	SBP4: Population Health
	SBP5: Physician Role in Health Care Systems
PBLI1: Teaching	
PBLI2: Self-directed Learning	PBLI1: Evidence-Based and Informed Practice PBLI2: Reflective Practice and Commitment to Personal Growth
PBLI3: Quality Improvement	SBP2: Quality Improvement
PROF1: Integrity	PROF1: Professional Behavior PROF2: Ethical Principles
PROF2: Personal Wellbeing	PROF4: Self-Awareness and Help-Seeking
PROF3: Administrative Tasks	PROF3: Accountability/Conscientiousness
ICS1: Communication with Patients and Families	ICS1: Patient and Family-Centered Communication
ICS2: Communications with Healthcare Team	ICS2: Interprofessional and Team Communication
	ICS3: Communication within Health Care Systems

Available Milestones Resources

Milestones 2.0: Assessment, Implementation, and Clinical Competency Committees Supplement, 2021 - *https://meridian.allenpress.com/jgme/issue/13/2s*

Milestones Guidebooks: https://www.acgme.org/milestones/resources/

- *Assessment Guidebook*
- *Clinical Competency Committee Guidebook*
- *Clinical Competency Committee Guidebook Executive Summaries*
- *Implementation Guidebook*
- *Milestones Guidebook*

Milestones Guidebook for Residents and Fellows: https://www.acgme.org/residents-and-fellows/the-acgme-for-residents-and-fellows/

- Milestones Guidebook for Residents and Fellows
- Milestones Guidebook for Residents and Fellows Presentation
- Milestones 2.0 Guide Sheet for Residents and Fellows

Milestones Research and Reports: https://www.acgme.org/milestones/research/

- *Milestones National Report*, updated each fall
- *Milestones Predictive Probability Report,* updated each fall
- *Milestones Bibliography*, updated twice each year

Developing Faculty Competencies in Assessment courses - https://www.acgme.org/meetings-and-educational-activities/courses-and-workshops/developing-faculty-competencies-in-assessment/

Assessment Tool: Direct Observation of Clinical Care (DOCC) - https://dl.acgme.org/pages/assessment

Assessment Tool: Teamwork Effectiveness Assessment Module (TEAM) - https://team.acgme.org/

Improving Assessment Using Direct Observation Toolkit - https://dl.acgme.org/pages/acgme-faculty-development-toolkit-improving-assessment-using-direct-observation

Remediation Toolkit - https://dl.acgme.org/courses/acgme-remediation-toolkit

Learn at ACGME has several courses on Assessment and Milestones - https://dl.acgme.org/