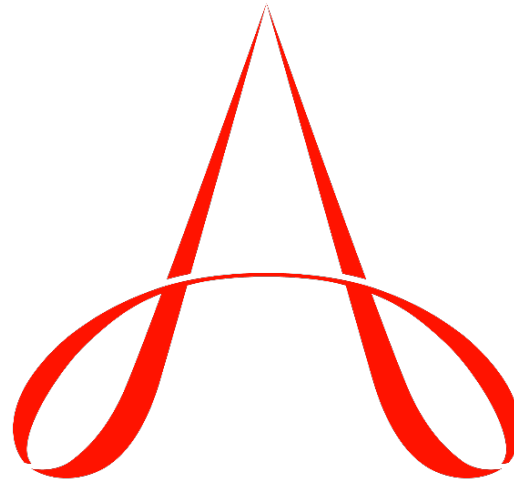




# Supplemental Guide: Thoracic Surgery – Integrated



A C G M E

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### **Milestones Supplemental Guide**

This document provides additional guidance and examples for the Thoracic Surgery – Integrated 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.

| <b>Patient Care 1: Ischemic Heart Disease</b>  |  |
|--|--|
| <b>Overall Intent:</b> To manage patients with ischemic heart disease  |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Performs a disease specific history and physical and develops a diagnostic plan for a patient with ischemic heart disease</i></p> <p><i>Assists in routine coronary procedures, including set-up and positioning</i></p> <p><i>Performs routine post-operative care and recognizes complications of coronary procedures</i></p> | <ul style="list-style-type: none"> <li>● Identifies risk factors for coronary disease, performs physical exam including vascular exam, and knows the indications for ordering coronary angiography and echocardiogram</li> <li>● Properly positions the patient for sternotomy and holds retraction of the heart, and lists steps of the procedure</li> <li>● Orders electrolyte replacement, interprets rhythm disturbances, removes chest tube, and recognizes a wound infection and bleeding</li> </ul> |
| <p><b>Level 2</b> <i>Interprets diagnostic testing and develops a treatment plan, including outpatient follow-up, for a patient with routine ischemic heart disease</i></p> <p><i>Performs components of coronary procedures</i></p> <p><i>Manages simple post-operative complications of coronary procedures</i></p>                                | <ul style="list-style-type: none"> <li>● Identifies stenosis and targets on coronary angiogram</li> <li>● Identifies wall motion abnormalities on echocardiogram</li> <li>● Knows the indications for a primary coronary artery bypass grafting (CABG) and can discuss conduit selection and targets for different patients</li> <li>● Performs conduit preparation, cannulation, or proximal anastomosis</li> <li>● Manages atrial fibrillation, postoperative hypotension, bleeding</li> </ul>           |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with complex ischemic heart disease</i></p> <p><i>Performs basic coronary procedures and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications of coronary</i></p>                            | <ul style="list-style-type: none"> <li>● Identifies concomitant valvular disease on echocardiogram</li> <li>● Suggests appropriate revascularization for a redo-CABG</li> <li>● Performs primary CABG in a patient with preserved ventricular function</li> <li>● Recognizes failure to wean off bypass or protamine reactions</li> <li>● Recognizes and develops management plan for graft occlusion or tamponade</li> </ul>  |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with multiple comorbidities and complex ischemic heart disease</i></p>   | <ul style="list-style-type: none"> <li>● Develops a treatment plan for a patient with primary CABG with low ejection fraction</li> </ul>   |

|  |   |
|--|---|
| <i>Performs complex coronary procedures and manages intra-operative complications</i>                            | <ul style="list-style-type: none"> <li>• Performs repeat CABG, CABG for patients with low ejection fraction, primary valve-CABG, or primary CABG in patients with multiple prior stents</li> <li>• Manages protamine reaction or failure to wean off bypass</li> </ul>  |
| <i>Manages complex complications of coronary procedures in critically ill patients</i>                           | <ul style="list-style-type: none"> <li>• Manages graft occlusion or tamponade in patients who are hemodynamically unstable</li> </ul>   |
| <b>Level 5</b> <i>Performs advanced coronary procedures</i>  | <ul style="list-style-type: none"> <li>• Performs left ventricular aneurysm repair (LVAR) or post-infarct ventricular septal defect (VSD)</li> </ul>  |
| <i>Manages advanced intra-and post-operative complications of coronary procedures in critically ill patients</i> | <ul style="list-style-type: none"> <li>• Manages iatrogenic type A dissection</li> <li>• Manages air embolus</li> </ul>   |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>• Direct observation</li> <li>• End-of-rotation evaluation</li> <li>• Medical record (chart) review</li> <li>• Mock orals</li> <li>• Simulation</li> </ul>   |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>•</li> </ul>   |
| Notes or Resources   | <ul style="list-style-type: none"> <li>• Thoracic Surgery Directors Association (TSDA). Cardiac Surgery Simulation Curriculum. <a href="https://tsda.org/">https://tsda.org/</a>. 2020.</li> <li>• The Society of Thoracic Surgeons (STS). <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul> |

| <b>PC1: Ischemic Heart Disease Examples of Routine, Complex, and Advanced</b> |  |  |
|---|--|--|
| <b>Procedures</b>   |  |  |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>  |
| Primary CABG, Normal EF, First Sternotomy                                     | Primary CABG, Low EF, First Sternotomy<br>Primary Valve-CABG<br>Redosternotomy, Primary CABG | Redo CABG<br>LV Aneurysm Repair<br>Post-infarct VSD                            |
| <b>Complications</b>  |  |  |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>  |
| Atrial fibrillation, postoperative hypotension, bleeding,                     | Graft occlusion, tamponade, protamine reaction   | Iatrogenic type A dissection<br>Inability to wean from cardio-pulmonary bypass |

| <b>Patient Care 2: Mechanical Circulatory Support</b>  |  |
|--|--|
| <b>Overall Intent:</b> To manage and troubleshoot mechanical circulatory support   |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Identifies a patient in need of mechanical circulatory support</i></p> <p><i>Assists in routine procedures, including set-up and positioning</i></p>  | <ul style="list-style-type: none"> <li>● Identifies a patient who fails to wean from cardiopulmonary bypass or patient with cardiogenic shock after ST-segment-elevated myocardial infarction (STEMI)</li> <li>● Properly positions patient for extracorporeal membrane oxygenation (ECMO) or intra-aortic balloon pump (IABP), can prepare equipment necessary prior procedure</li> </ul> |
| <p><b>Level 2</b> <i>Develops a diagnostic and treatment plan for a patient in need of mechanical circulatory support</i></p> <p><i>Assists in initiation of mechanical circulatory support</i></p>                              | <ul style="list-style-type: none"> <li>● Determines appropriate support device for individual patient such as venous arterial versus veno-venous ECMO or need for balloon pump</li> <li>● Obtains arterial and venous access, manages wires during IABP placement, chooses appropriate size and type of cannulas for ECMO</li> </ul>   |
| <p><b>Level 3</b> <i>Develops a treatment plan for a patient in need of mechanical circulatory support with complex disease</i></p> <p><i>Performs components of mechanical circulatory support</i></p>                          | <ul style="list-style-type: none"> <li>● Manages a patient with an IABP with aortic insufficiency, develops an ECMO plan for a patient pulmonary hypertension, develops a plan for a patient with biventricular failure</li> <li>● Places cannulas for ECMO, positions IABP under imaging guidance, performs vascular cut down for access</li> </ul>                                       |
| <p><b>Level 4</b> <i>Manages a patient on mechanical circulatory support and knows the principles of weaning a patient</i></p> <p><i>Initiates routine mechanical circulatory support, and manages routine complications</i></p> | <ul style="list-style-type: none"> <li>● Adjusts timing of IABP and can troubleshoot waveform, appropriately weans flow on venous arterial ECMO</li> <li>● Manages cold leg after placement of IABP, bleeding around cannula sites</li> </ul>  |
| <p><b>Level 5</b> <i>Manages a patient who is able to be discontinued from mechanical circulatory support or in need of long-term strategy for end-stage failure</i></p>   | <ul style="list-style-type: none"> <li>● Places durable left ventricular assist device, total abdominal hysterectomy, performs transplant</li> </ul>   |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation evaluation</li> <li>● Mock orals</li> <li>● Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>  | <ul style="list-style-type: none"> <li>● TSDA. Cardiac Surgery Simulation Curriculum. <a href="https://tsda.org/">https://tsda.org/</a>. 2020.</li> </ul>  |

• STS. <https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum>. 2021

| <b>PC2: Mechanical Circulatory Support Examples of Routine, Complex, and Advanced</b>                             |  |  |
|---|--|--|
| <b>Procedures</b>   |  |  |
| <b>Routine</b>  | <b>Advanced</b>                                    |  |
| ECMO<br>Intra-aortic balloon pump<br>From the former complex category: Temporary MCS (Impella, Centrimag, Tandem) | Durable LVAD, BiVAD                                |  |
| <b>Complications</b>  |  |  |
| <b>Routine</b>  | <b>Complex</b>                                     | <b>Advanced</b>  |
| bleeding, coagulopathy, thrombus in pump or circuit, arrhythmias, suction events                                  | peripheral ischemia, LV distension/pulmonary edema | Right ventricular failure, Acute pump thrombosis, Differential upper and lower extremity perfusion |

| <b>Patient Care 3: Valvular Disease</b>  |   |
|--|---|
| <b>Overall Intent:</b> To manage patients with valvular heart disease  |   |
| <b>Milestones</b>  | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Performs a disease specific history and physical and develops a diagnostic plan for patients with valvular heart disease</i></p> <p><i>Assists in routine procedures, including set-up and positioning, for patients with valvular heart disease</i></p> <p><i>Performs routine post-operative care and recognizes complications related to heart valve surgery</i></p> | <ul style="list-style-type: none"> <li>● Identifies murmurs of aortic stenosis, aortic insufficiency, mitral stenosis, and mitral insufficiency</li> <li>● Identifies indications for echocardiogram in patients with suspected valvular disease</li> <br/> <li>● First-assists on the performance of aortic and mitral valve procedures</li> <br/> <li>● Identifies postoperative arrhythmias including atrial fibrillation</li> <li>● Understands use of inotropes in routine post-operative patient</li> </ul> |
| <p><b>Level 2</b> <i>Interprets diagnostic testing and develops a treatment plan for a patient with routine valvular heart disease</i></p> <p><i>Performs components of routine procedures for patients undergoing surgery for valvular heart disease</i></p> <p><i>Manages routine post-operative complications</i></p>   | <ul style="list-style-type: none"> <li>● Identifies aortic stenosis, aortic insufficiency, mitral stenosis, and mitral insufficiency on echocardiogram</li> <li>● Identifies indications for valve surgery</li> <br/> <li>● Performs sternotomies, cannulation, and suture placement for valve procedures</li> <br/> <li>● Manages post-operative arrhythmias and postoperative bleeding</li> </ul>   |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with complex valvular heart disease</i></p> <p><i>Performs basic procedures on patients with valvular heart disease and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications</i></p>   | <ul style="list-style-type: none"> <li>● Identifies candidates for valve repair versus replacement versus percutaneous valve therapies</li> <br/> <li>● Performs aortic valve replacement, mitral valve replacement, tricuspid valve repair</li> <li>● Identifies and creates a plan for treatment of paravalvular leak or systolic anterior motion (SAM)</li> <br/> <li>● Identifies and creates a plan for treatment of post-operative tamponade, heart block, or hemolysis after valve surgery</li> </ul>      |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with multiple</i></p>  | <ul style="list-style-type: none"> <li>● Develops a plan for patients with multivalvular disease</li> <li>● Develops a plan for patients with valvular disease and low ejection fraction</li> </ul>   |



|   |  |
|---|--|
| <p><i>comorbidities and advanced valvular heart disease</i></p> <p><i>Performs complex procedures and manages intra-operative complications in patients undergoing surgery for valvular heart disease</i></p> <p><i>Manages complex complications</i></p> | <ul style="list-style-type: none"> <li>● Performs mitral valve repair</li> <li>● Performs multivalvular replacement</li> <li>● Manages patient with small aortic root</li> <li>● Performs transcatheter aortic valve replacement (TAVR)</li> <li>● Manages systolic anterior motion</li> <li>● Manages endocarditis of a prosthetic valve with systemic manifestations</li> <li>● Manages patient with valve thrombosis</li> </ul> |
| <p><b>Level 5</b> <i>Performs advanced procedures for valvular heart disease</i></p> <p><i>Manages advanced intra- and post-operative complications</i></p>   | <ul style="list-style-type: none"> <li>● Performs redo-valvular surgery</li> <li>● Manages aortic root abscess</li> <li>● Manages complications of multi-valve surgery</li> <li>● Manages atrioventricular groove disassociation</li> </ul>  |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation review</li> <li>● Medical record (chart) review</li> <li>● Mock oral</li> <li>● Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● TSDA. Cardiac Surgery Simulation Curriculum. <a href="https://tsda.org/">https://tsda.org/</a>. 2020.</li> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul>  |

| <b>PC3: Valvular Disease Examples of Routine, Complex, and Advanced</b>  |   |  |
|--|---|--|
| <b>Diseases</b>  |   |  |
| <b>Routine</b>   | <b>Complex</b>  |  |
|  | surgical vs. transcatheter  |  |
| <b>Procedures</b>  |   |  |
| <b>Routine</b>   | <b>Complex</b>  | <b>Advanced</b>  |
| Aortic Valve Replacement<br>Mitral Valve Replacement<br><br>BASIC<br>paravalvular leak, systolic anterior motion | Aortic Root Replacement (Bentall)<br>Mitral Valve Repair<br>Double Valve Replacement<br>Arrhythmia Procedures   | Aortic Valve Repair<br>Aortic Root Replacement (any other than Bentall)<br>Redo Valve Replacement<br>Aortic root enlargement |
| <b>Complications</b>   |   |  |
| <b>Routine</b>   | <b>Complex</b>  | <b>Advanced</b>  |
| heart block, atrial fibrillation, hypotension, bleeding, tamponade   | SAM, small aortic root/PPM, occluded/kinked coronary button, paravalvular leak, left circumflex injury, calcified mitral annulus, A-V groove disruption | Management of aortic root abscess<br>Management of complications of multi-valve surgery                                      |

| <b>Patient Care 4: Great Vessel Disease</b>  |  |
|--|--|
| <b>Overall Intent:</b> To manage patients with great vessel disease  |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Performs a disease-specific history and physical and develops a diagnostic plan for patients with disease of the great vessels</i></p> <p><i>Assists in routine procedures, including set-up and positioning for patients with disease of the great vessels</i></p> <p><i>Performs routine post-operative care and recognizes complications in patients with disease of the great vessels</i></p> | <ul style="list-style-type: none"> <li>● Identifies risk factors for great vessel disease, family history, connective tissue disorders, performs physical exam including vascular exam, and knows the indications for ordering coronary angiography, computerized tomography (CT) scan, and echocardiogram</li> <li>● Properly positions the patient for sternotomy, and follows suture; lists steps of the procedure</li> <li>● Orders electrolyte replacement, interprets rhythm disturbances, removes chest tube, and recognizes a wound infection and bleeding</li> </ul>  |
| <p><b>Level 2</b> <i>Interprets diagnostic testing and develops a treatment plan, including outpatient follow-up, for a patient with routine great vessel disease</i></p> <p><i>Performs components of routine procedures on the great vessels</i></p> <p><i>Manages simple post-operative complications in patients with disease of the great vessels</i></p>   | <ul style="list-style-type: none"> <li>● Identifies extent of aneurysm and knows the indications for repair</li> <li>● Performs cannulation, resection, and mobilization of aneurysm/dissection</li> <li>● Manages atrial fibrillation, postoperative hypotension, bleeding, and stroke</li> </ul>   |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with complex disease of the great vessels</i></p> <p><i>Plans and performs basic procedures and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications</i></p>   | <ul style="list-style-type: none"> <li>● Identifies extent of dissection and concomitant wall motion and valvular abnormalities on echocardiogram, and knows the indications for concomitant valve replacement or CABG and can discuss cannulation strategies</li> <li>● Identifies perfusion strategy, plan for hypothermia and cerebral protection, graft selection and placement; recognizes failure to wean off bypass, protamine reactions, and coagulopathy</li> <li>● Recognizes and develops management plan for tamponade, malperfusion, aortic pseudoaneurysms, residual dissection, or aneurysmal degeneration of native aorta</li> </ul> |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with multiple</i></p>  | <ul style="list-style-type: none"> <li>● Develops a treatment plan for a patient with aneurysm and aortic insufficiency, low ejection fraction, or coronary artery disease</li> </ul>  |

|   |   |
|---|---|
| <p><i>comorbidities and complex disease of the great vessels</i></p> <p><i>Plans and performs complex procedures and manages intra-operative complications</i></p> <p><i>Manages complex complications in critically ill patients</i></p> | <ul style="list-style-type: none"> <li>• Performs extended aortic replacement, and manages protamine reaction or failure to wean off bypass</li> <li>• Manages coronary artery ischemia, tamponade, or malperfusion in patients who are hemodynamically unstable</li> </ul>   |
| <p><b>Level 5</b> <i>Performs advanced procedures</i></p> <p><i>Manages advanced intra- and post-operative complications</i></p>  | <ul style="list-style-type: none"> <li>• Performs reoperative aortic root replacement, thoracoabdominal aortic replacement, hybrid great vessel repair</li> <li>• Manages iatrogenic type A dissection or air embolus</li> </ul>  |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>• Chart review</li> <li>• Direct observation</li> <li>• End-of-rotation review</li> <li>• Mock oral</li> <li>• Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>•</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>• TSDA. Cardiac Surgery Simulation Curriculum. <a href="https://tsda.org/">https://tsda.org/</a>. 2020.</li> <li>• STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul> |

| <b>PC4: Great Vessel Disease Examples of Routine, Complex, and Advanced</b> |  |   |
|---|--|---|
| <b>Procedures</b>   |  |   |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>   |
| Ascending Aortic Replacement  | Type A Aortic Dissection Repair<br>Combined Valve-Ascending Aortic Surgery             | TEVAR<br>Thoraco-abdominal Aortic Aneurysm Surgery                      |
| <b>Complications</b>  |  |   |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>   |
| Bleeding, hypothermia   | Acute coronary ischemia<br>Need for aortic arch replacement<br>Acute cerebral ischemia | Acute spinal cord ischemia<br>Acute end-organ ischemia following repair |

**Patient Care 5: Esophagus**

**Overall Intent:** To manage patients with benign or malignant esophageal disease

| Milestones  | Examples   |
|---|--|
| <p><b>Level 1</b> <i>Performs a disease specific history and physical and develops a diagnostic plan</i></p> <p><i>Assists in routine procedures, including set-up and positioning</i></p> <p><i>Performs routine post-operative care and recognizes complications</i></p>                        | <ul style="list-style-type: none"> <li>● Identifies risk factors for benign and malignant esophageal disease, performs physical exam including degree of dysphagia, and knows the indications for ordering esophagram or endoscopy</li> <li>● Properly positions the patient for esophagectomy and proper exposure of the neck for a cervical anastomosis; lists steps of the procedure</li> <li>● Orders electrolyte replacement, initiates tube feeds, identifies and manages aspiration, and recognizes chylothorax and a wound infection and bleeding</li> </ul> |
| <p><b>Level 2</b> <i>Develops a treatment plan, including outpatient follow-up, for patients with routine esophageal disease</i></p> <p><i>Performs components of procedures</i></p> <p><i>Manages routine post-operative complications</i></p>   | <ul style="list-style-type: none"> <li>● Identifies the need for pre/post-chemoradiation, choice of surgical procedure, prehabilitation, or manometry for patients with routine esophageal disease</li> <li>● Performs mobilization of a gastric conduit, placement of a J-tube, or exposure of a cervical esophagus</li> <li>● Manages aspiration pneumonia, ileus, or gastric outlet obstruction</li> </ul>  |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for patients with complex esophageal disease</i></p> <p><i>Performs routine procedures and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications</i></p> | <ul style="list-style-type: none"> <li>● Develops a plan for patients with achalasia, locally advanced esophageal cancer, or giant paraesophageal hernia</li> <li>● Performs first time fundoplication, foreign body removal, or esophagogastroduodenoscopy (EGD) with dilation</li> <li>● Recognizes and develops a plan for leaks, chylothorax, or dehiscence</li> </ul>   |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with multiple comorbidities and complex esophageal disease</i></p> <p><i>Performs complex procedures and manages intra-operative complications</i></p>  | <ul style="list-style-type: none"> <li>● Develops a treatment plan for patients needing salvage esophagectomy, esophagectomy with prior chest surgery, or for obesity</li> <li>● Performs minimally invasive esophagectomy, giant paraesophageal hernia, and Collis-Nissen</li> </ul>  |

|   |  |
|---|--|
| <i>Manages complex complications in critically ill patients</i>   | <ul style="list-style-type: none"> <li>• Manages ischemic conduit with sepsis, cervical leak with mediastinal extension, intraoperative airway injury, or intraoperative ischemic gastric conduit</li> </ul>   |
| <p><b>Level 5</b> <i>Develops a treatment plan for a patient condition that does not have clear guidelines</i></p> <p><i>Performs advanced procedures and manages intra-operative complications</i></p> <p><i>Manages advanced complications without clear guidelines</i></p> | <ul style="list-style-type: none"> <li>• Develops a management plan for patients with esophageal discontinuity</li> <li>• Performs esophagectomy with non-gastric conduit, Redo fundoplication, or esophagectomy after prior fundoplication</li> <li>• Manages aorto-enteric fistula, esophageal complication of thoracic endovascular aortic repair (TEVAR), or chylothorax post-duct ligation</li> </ul> |
| Assessment Models or Tools  | <ul style="list-style-type: none"> <li>• Chart review</li> <li>• Direct observation</li> <li>• End-of-rotation review</li> <li>• Mock oral</li> <li>• Simulation</li> </ul>  |
| Curriculum Mapping  | •  |
| Notes or Resources  | • STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a> . 2021  |

| <b>PC 5: Esophagus Examples of Routine, Complex, and Advanced Diseases</b>                              |  |   |
|---|--|---|
| <b>Diseases</b>   |  |   |
| <b>Routine</b>  | <b>Complex</b>   |   |
| Initial Reflux<br>Foreign body impaction<br>Leiomyoma<br>Diverticula<br>Barrets<br>PEH<br>Hiatal Hernia | Achalasia/Mobility Disorders<br>Perforation<br>Esophageal Cancer<br>Stricture<br>Fistula<br>Trauma<br>Congenital disorders<br>Post-endoscopic Complications<br>Recurrent Reflux<br>Recurrent Hernia<br>Giant PEH |   |
| <b>Procedures</b>   |  |   |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>                         |
| EGD<br>Dialation  | Stent<br>Heller myotomy  | Redo plication<br>Belsey fundoplication |

|  |  |   |
|--|--|---|
| Hiatal hernia repair<br>First time fundoplication  | Collis<br>Repair esophageal perforation<br>Esophageal diversion<br>Open esophagectomy<br>MIE (VATS or robotic)<br>POEM<br>Enucleation<br>Diverticulectomy<br>Giant PEH<br>Penetrating injuries | Esophagectomy with non-gastric conduit<br>Complex esophagectomy (prior fundoplication)<br>Management corrosive injury |
| <b>Complications</b>   |  |   |
| <b>Routine</b>   | <b>Complex</b>   | <b>Advanced</b>   |
| Stricture<br>Afib<br>Atelectasis<br>Pneumonia<br>Fever<br>Arrhythmia<br>Recurrent nerve injury<br>Aspiration<br>DVT/PE<br>Ileus<br>Bleeding<br>UTI | Leak<br>Dehiscence<br>Chylothorax<br>Fistula<br>Conduit necrosis<br>Death<br>Empyema<br>Airway injury<br>Perforation<br>Conduit dysmotility  |   |

| <b>Patient Care 6: Lung and Airway</b>  |  |
|---|--|
| <b>Overall Intent:</b> To manage patients with benign or malignant lung and airway disease  |  |
| <b>Milestones</b>   | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Performs a disease specific history and physical and develops a diagnostic plan</i></p> <p><i>Assists in routine procedures, including set-up and positioning</i></p> <p><i>Performs routine post-operative care and recognizes complications</i></p>  | <ul style="list-style-type: none"> <li>● Identifies risk factors for lung cancer, assesses functional status, and knows the indications for ordering pulmonary function tests, CT, positron emission tomography (PET) imaging</li> <li>● Assists in lateral decubitus positioning for thoracic procedures</li> <li>● Drives a thoracoscope during video-assisted thoracic surgery (VATS) procedures</li> <li>● Removes chest tubes</li> <li>● Identifies air leak</li> </ul>   |
| <p><b>Level 2</b> <i>Interprets diagnostic testing and develops a treatment plan, including outpatient follow-up, for a patient with routine disease</i></p> <p><i>Performs bedside procedures and components of routine procedures</i></p> <p><i>Manages routine post-operative complications</i></p>                                    | <ul style="list-style-type: none"> <li>● Identifies a treatment plan for solitary pulmonary nodules</li> <li>● Identifies a diagnostic plan for patient with interstitial lung disease</li> <li>● Develops a treatment plan for an early-stage lung cancer patient with normal pulmonary function tests</li> <li>● Performs flexible bronchoscopy, VATS port placement, posterolateral thoracotomy, or division of individual structures during lobectomy (vein, artery)</li> <li>● Manages hemothorax, pleural effusion, prolonged air leak, atrial fibrillation, or surgical site infection</li> </ul> |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with routine disease and multiple comorbidities or anatomic complexity</i></p> <p><i>Performs routine procedures and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications</i></p> | <ul style="list-style-type: none"> <li>● Develops a treatment plan for a patient with locally invasive lung cancer</li> <li>● Develops a treatment plan for a patient with early-stage lung cancer and limited pulmonary reserve</li> <li>● Performs lung biopsy, wedge resection, open lobectomy, or tracheostomy</li> <li>● Recognizes and creates a plan for management of bronchopleural fistula, empyema, respiratory failure, vascular injury, or chylothorax</li> </ul>   |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with complex disease</i></p>  | <ul style="list-style-type: none"> <li>● Develops a treatment plan for a patient with tracheal tumors, including anesthetic management</li> </ul>  |



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| <p><i>Performs complex procedures and manages intra-operative complications</i></p>                        | <ul style="list-style-type: none"> <li>● Performs segmentectomy, pneumonectomy, extended pulmonary resections, or minimally invasive lobectomy</li> </ul>  |
| <p><i>Manages complex complications in critically ill patients</i></p>                                     | <ul style="list-style-type: none"> <li>● Manages bronchopleural fistula, empyema, respiratory failure, vascular injury, and chylothorax</li> </ul>   |
| <p><b>Level 5</b> <i>Develops a treatment plan for a condition that does not have clear guidelines</i></p> | <ul style="list-style-type: none"> <li>● Develops a treatment plan for immunosuppressed patients with pulmonary complications</li> </ul>   |
| <p><i>Performs advanced procedures and manages intra-operative complications</i></p>                       | <ul style="list-style-type: none"> <li>● Performs completion pneumonectomy, sleeve/ bronchoplasty, tracheal resection and reconstruction or resection of pancoast tumors</li> </ul>                                    |
| <p><i>Manages advanced complications without clear guidelines</i></p>                                      | <ul style="list-style-type: none"> <li>● Manages tracheo-innominate fistula</li> </ul>   |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Chart review</li> <li>● Direct observation</li> <li>● End-of-rotation review</li> <li>● Mock oral</li> </ul>  |
| <p>Curriculum Mapping</p>  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>  | <ul style="list-style-type: none"> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul> |

| <b>PC6: Lung and Airway Examples of Routine, Complex, and Advanced</b>  |  |  |  |
|---|--|--|--|
| <b>Diseases</b>   |  |  |  |
| <b>Routine</b>  |  | <b>Complex</b>   |  |
| Solitary Lung Nodule<br>Early Stage Lung Cancer<br>Metastasis to Lung<br>Stable Hemoptysis<br>Tracheal Stenosis<br>Pulmonary Sequestration<br>Carcinoid |  | Locally Advanced Lung Cancer<br>Severe Bullous Emphysema<br>End Stage COPD<br>End Stage Lung Disease (Cystic Fibrosis, etc)<br>Lung Abscess<br>Bronchopleural Fistula<br>Massive Hemoptysis<br>Tracheal Malignancy |  |
| <b>Procedures</b>   |  |  |  |
| <b>Bedside procedures/components</b>  | <b>Routine</b>   | <b>Complex</b>   | <b>Advanced</b>  |
| Flexible Bronchoscopy<br>Port Placement<br>Thoracotomy<br>Division of individual structures during lobectomy (vein, artery)                             | Lung biopsy<br>Wedge resection<br>Lobectomy<br>Tracheostomy  | Segmentectomy<br>Pneumonectomy<br>Extended pulmonary resections<br>Minimally invasive lobectomy<br>Interventional Bronchoscopy / EBUS  | Sleeve/ bronchoplasty<br>Tracheal resection<br>Pancoast Tumor<br>Lung Volume Resection Surgery<br>Rigid Bronchoscopy |
| <b>(Post-operative) Complications</b>   |  |  |  |
| <b>Routine (simple)</b>   | <b>Complex</b>   |  | <b>Advanced</b>  |
| Hemothorax<br>Effusion<br>Prolonged airleak<br>Atrial fibrillation<br>Surgical site infection<br>Nerve injury   | Bronchopleural fistula<br>Empyema<br>Respiratory failure<br>Vascular injury<br>Chylothorax<br>Tracheo-Innominate fistula |  |  |

| <b>Patient Care 7: Chest Wall/Pleura/Mediastinum/Diaphragm</b>   |   |
|--|---|
| <b>Overall Intent:</b> To manage patients with chest wall, pleural, mediastinal, and diaphragmatic disease   |   |
| <b>Milestones</b>  | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Performs a disease-specific history and physical and develops a diagnostic plan</i></p> <p><i>Assists in routine procedures, including set-up and positioning</i></p> <p><i>Performs routine post-operative care and recognizes complications</i></p>                             | <ul style="list-style-type: none"> <li>● Identifies risk factors, performs physical exam including assessing for lymphadenopathy, and knows the indications for ordering CT scan or tumor markers</li> <li>● Properly positions the patient for the procedure, holds retraction, and follow suture; lists steps of the procedure</li> <li>● Orders electrolyte replacement, interprets rhythm disturbances, removes chest tube, and recognizes a wound infection or bleeding</li> </ul> |
| <p><b>Level 2</b> <i>Interprets diagnostic testing and develops a treatment plan, including outpatient follow-up, for a patient with routine disease</i></p> <p><i>Performs bedside procedures and components of routine procedures</i></p> <p><i>Manages routine post-operative complications</i></p> | <ul style="list-style-type: none"> <li>● Uses imaging to identify the location and extent of chest pathology including mediastinal mass, and pleural versus parenchymal disease; develops treatment plans for pneumothorax, malignant effusion, or chest wall infections</li> <li>● Performs tube thoracostomy or intrapleural lytic therapy</li> <li>● Manages atrial fibrillation, postoperative hypotension, or bleeding</li> </ul>  |
| <p><b>Level 3</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with complex disease</i></p> <p><i>Performs routine procedures and recognizes intra-operative complications</i></p> <p><i>Recognizes and creates a plan for complex complications</i></p>                | <ul style="list-style-type: none"> <li>● Develops a treatment plan for a patient with thoracic outlet syndromes, mediastinal tumors, and bronchopleural fistula</li> <li>● Performs pleurodesis, sympathectomy, or pericardial window</li> <li>● Recognizes and creates a plan for empyema, vascular injury, diaphragmatic disruption, or chylothorax</li> </ul>  |
| <p><b>Level 4</b> <i>Develops a treatment plan, including outpatient follow-up, for a patient with multiple comorbidities and complex disease</i></p> <p><i>Performs complex procedures and manages intra-operative complications</i></p>  | <ul style="list-style-type: none"> <li>● Develops a treatment plan for an immunosuppressed or malnourished patient with thoracic outlet syndrome, mediastinal tumors, or bronchopleural fistula</li> <li>● Performs decortication, diaphragm plication, or mediastinal mass resection</li> </ul>  |

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| <i>Manages complex complications in critically ill patients</i>  | <ul style="list-style-type: none"> <li>● Manages empyema, vascular injury, diaphragmatic disruption, or chylothorax</li> </ul>   |
| <p><b>Level 5</b> <i>Performs advanced procedures</i></p> <p><i>Manages advanced intra- and post-operative complications</i></p> | <ul style="list-style-type: none"> <li>● Performs pancoast tumor resection, extra pleural pneumonectomy, or pericardiectomy</li> <li>● Manages cardiac herniation or injuries</li> </ul>                               |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation evaluation</li> <li>● Medical record (chart) review</li> <li>● Mock orals</li> </ul>  |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| Notes or Resources   | <ul style="list-style-type: none"> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul> |

| <b>PC7: Chest Wall/Pleura/Mediastinum Examples of Routine, Complex, and Advanced</b>   |  |  |  |
|--|--|--|--|
| <b>Diseases</b>  |  |  |  |
| <b>Routine</b>   |  | <b>Complex</b>   |  |
| Chylothorax<br>Hyperhidrosis<br>Hemothorax<br>Pneumothorax/Pneumomediastinum<br>Malignant effusion<br>Fibrothorax<br>Chest Wall Infections |  | Malignant Pleural Mesothelioma<br>Thoracic Outlet Syndromes<br>Chest wall tumors<br>Pectus Excavatum<br>Mediastinal Tumors<br>Bronchopleural fistula<br>Diaphragm Rupture  |  |
| <b>Procedures</b>  |  |  |  |
| <b>Bedside procedures/components</b>   | <b>Basic</b>   | <b>Complex</b>   | <b>Advanced</b>  |
| Port placement<br>Thoracotomy<br>Tube thoracostomy<br>Thoracentesis<br>Intercostal muscle harvest  | Mediastinoscopy/<br>Chamberlin<br>Pleurodesis<br>PleurX Catheter<br>Pleural Biopsy<br>Rib Plating<br>Evacuation of Hemothorax<br>Sympathectomy<br>Mediastinal drainage<br>Pericardial window | Decortication<br>Diaphragm repair/ resection<br>Mediastinal mass/cyst resection<br>Thoracic Outlet Syndrome<br>Pectus excavatum<br>Chest wall/ Sternal reconstruction<br>Diaphragm plication<br>Congenital diaphragmatic hernia<br>Congenital cystic adenomatoid malformation (CCAM) | Pancoast Tumor<br>Extra Pleural<br>Pneumonectomy with<br>Pleurectomy<br>Decortication<br>Pericardiectomy |
| <b>Complications</b>   |  |  |  |
| <b>Routine (simple)</b>  | <b>Complex</b>   |  | <b>Advanced</b>  |
| Effusion<br>Hemothorax<br>Pneumothorax<br>Atrial fibrillation<br>Nerve injury (Recurrent/Phrenic)<br>Surgical site infection               | Empyema<br>Infected hardware/implant<br>Vascular injury<br>Diaphragmatic disruption<br>Chylothorax   |  |  |

**Patient Care 8: Critical Care**

**Overall Intent:** To manage patients with critical illness

| Milestones   | Examples   |
|--|--|
| <p><b>Level 1</b> <i>Interprets diagnostic data for a critically ill patient</i></p> <p><i>Performs routine critical care-related procedures</i></p>   | <ul style="list-style-type: none"> <li>● Determine type of shock, interprets pulmonary artery catheter, interprets ventilator data, uses intensive care unit (ICU) flowsheet, determines volume status, etc.</li> <li>● Places a radial/femoral arterial line, central lines, percutaneous chest drain, or Swan-Ganz catheter</li> </ul>   |
| <p><b>Level 2</b> <i>Implements a treatment plan for peri-operative patients with routine procedures</i></p> <p><i>Recognizes need for complex procedures</i></p>                                      | <ul style="list-style-type: none"> <li>● Writes order for ventilator settings, manages inotropic support, determines nutrition needs relative to disease or procedure, and implements appropriate diet/tube feeds, and so on</li> <li>● Recognizes when to implement veno-venous ECMO, place a balloon pump, or re-open the chest</li> </ul>   |
| <p><b>Level 3</b> <i>Implements a treatment plan for peri-operative patients with complex procedures</i></p> <p><i>Performs complex bedside procedures</i></p>   | <ul style="list-style-type: none"> <li>● Creates a treatment plan for patient post-op from esophagectomy, type A dissection repair, or repaired ischemic VSD</li> <li>● Performs bedside sternal opening, places veno-venous ECMO, places a balloon pump, performs a tracheostomy, or performs a percutaneous endoscopic gastrostomy</li> </ul>  |
| <p><b>Level 4</b> <i>Implements a treatment plan for a patient with multiple comorbidities and complex disease</i></p> <p><i>Performs complex bedside procedures during an emergency situation</i></p> | <ul style="list-style-type: none"> <li>● Implements a treatment plan for ventricular dysfunction following coronary surgery, or manages cardiac ischemia/minimally invasive post-esophagectomy or major lung resection</li> <li>● Performs intubation with hemoptysis, placement of arterial lines during hypotension, or opens chest during active chest compressions to relieve tamponade</li> </ul> |
| <p><b>Level 5</b> <i>Implements a treatment plan for a patient condition that does not have clear guidelines</i></p> <p><i>Performs advanced bedside procedures</i></p>                                | <ul style="list-style-type: none"> <li>● Implements a treatment plan for patient on ECMO with no clear endpoint, and manages failure to wean from ventricular assist devices</li> <li>● Performs a bedside laparotomy or thoracotomy, revision coronary anastomosis, or placement of temporary mechanical support (e.g., Impella®, percutaneous left ventricular assist device)</li> </ul>             |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation evaluation</li> <li>● Medical record (chart) review</li> <li>● Mock orals</li> <li>● Simulation</li> </ul>  |

|                    |   |
|--------------------|---|
| Curriculum Mapping | •   |
| Notes or Resources | <ul style="list-style-type: none"> <li>• TSDA. Cardiac Surgery Simulation Curriculum. <a href="https://tsda.org/">https://tsda.org/</a>. 2020.</li> <li>• STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul> |

| <b>PC 8: Critical Care Examples of Routine, Complex, and Advanced</b>   |  |   |
|---|--|---|
| <b>Diseases</b>   |  |   |
| <b>Routine</b>  | <b>Complex</b>   |   |
| Distributive shock<br>Cardiogenic shock<br>Obstructive shock<br>Hypovolemic shock<br>Workup for cardiac transplantation<br>Workup for pulmonary transplantation<br>Postop care for pulmonary transplantation without complications<br>Postop care for cardiac transplantation without complications<br>Postop care for routine cardiac operations (CABG, isolated valve, valve + CABG, uncomplicated aortic replacement)<br>Routine postop care for cardiopulmonary operations complicated by 1 or less additional organ dysfunction (GI bleed, renal failure, liver failure, respiratory failure, etc)<br>Management of nutritional deficiencies<br>Management of kidney injury (initial workup, treatment, fluid and diuretic management, recognizing the need for renal replacement)<br>Management of respiratory failure and adjuncts for treatment | Any shock with complications<br>Heart failure treated with > 1 inotrope<br>Heart failure treated with a temporary or permanent device<br>RV failure treated with a temporary device (percutaneous or central RVAD)<br>RV failure treated with inhaled pulmonary vasodilators (NO, veletri, etc)<br>Hemodynamic instability treated with > 1 vasoactive infusion<br>Hypertensive emergency with complications (dissection, PAU) with the need for vasoactive infusions<br>Postop care for PTE<br>Postop care for complicated aortic surgery<br>Postop care for cardiac transplantation with complications (hemorrhage, tamponade, persistent lactate, open chest, mechanical support, etc)<br>Postop care for pulmonary transplantation (hemorrhage, tamponade, persistent lactate, open chest, mechanical support, etc)<br>Care of a patient with a disease complicated by multi-organ system dysfunction (renal failure, liver failure, respiratory failure, etc) |   |
| <b>Procedures</b>   |  |   |
| <b>Routine</b>  | <b>Complex</b>   | <b>Advanced</b>   |
| Central line (internal jugular, subclavian, femoral)<br>Arterial line (radial)<br>Intubation<br>Temporary dialysis catheter placement   | Arterial line (femoral, brachial)<br>TTE<br>TEE<br>IABP placement  | Arterial line (cut down approach)<br>Bedside surgical procedures (ex-lap, thoracotomy, reopening of sternotomy)<br>IABP placement |

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| <p>Transcutaneous pacing and defibrillation<br/>                 Cardioversion<br/>                 Management of epicardial pacemaker<br/>                 Management of nutritional deficiencies with enteral or parenteral nutrition</p> | <p>Flexible bronchoscopy with or without BAL, lavage, brushings, etc<br/>                 Transvenous pacemaker placement<br/>                 Intubation<br/>                 CPAP/BiPAP/ Invasive ventilator management</p> | <p>Placement of temporary mechanical support (ECMO, Impella, percutaneous RVAD)<br/>                 Tracheostomy<br/>                 Percutaneous gastrostomy tube placement (PEG)<br/>                 EGD<br/>                 Rigid bronchoscopy<br/>                 Flexible bronchoscopy with biopsy</p> |
| <b>Complications</b>  |   |  |
| <b>Routine</b>  | <b>Complex</b>  | <b>Advanced</b>  |
| <p>Single organ complication (hemorrhage, isolated organ failure, etc.)</p>   | <p>Multiorgan system failure</p>  |  |



| <b>Patient Care 9: Technical Skills for General Surgery</b>   |   |
|---|---|
| <b>Overall Intent:</b> To ensure the progressive development of technical skills needed to complete an operation including tissue handling, instrument use, and recognition of anatomy  |   |
| <b>Milestones</b>   | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Demonstrates limited tissue-handling skills</i></p> <p><i>Requires prompting to identify appropriate tissue plane</i></p> <p><i>Moves forward in the operation only with active direction</i></p>  | <ul style="list-style-type: none"> <li>● Examples in an open inguinal hernia repair:                             <ul style="list-style-type: none"> <li>○ Can place sutures with direction</li> <li>○ Can use electrocautery with supervising surgeon providing exposure and guidance</li> <li>○ Needs explicit direction to mark incision site</li> </ul> </li> <li>● Examples in laparoscopic cholecystectomy:                             <ul style="list-style-type: none"> <li>○ Establishes pneumoperitoneum</li> <li>○ Places trocars with direction</li> <li>○ Operates the camera</li> </ul> </li> </ul> |
| <p><b>Level 2</b> <i>Inconsistently demonstrates careful tissue handling</i></p> <p><i>Identifies appropriate plane but requires redirection to maintain dissection in the optimal tissue plane</i></p> <p><i>Moves forward in the operation but requires prompting to complete the operation</i></p> | <ul style="list-style-type: none"> <li>● Examples in laparoscopic cholecystectomy:                             <ul style="list-style-type: none"> <li>○ Appropriately places trocars without direction</li> <li>○ Dissects Calot’s Triangle with direction</li> <li>○ Identifies plane to remove gallbladder from liver bed with occasional straying off plane</li> </ul> </li> </ul>   |
| <p><b>Level 3</b> <i>Consistently demonstrates careful tissue handling</i></p> <p><i>Visualizes tissue plane, identifies and dissects relevant normal anatomy</i></p> <p><i>Moves fluidly through the course of the operation and anticipates next steps</i></p>                                      | <ul style="list-style-type: none"> <li>● Examples in laparoscopic cholecystectomy:                             <ul style="list-style-type: none"> <li>○ Dissects Calot’s Triangle to critical view of safety without direction</li> <li>○ Moves between steps of the procedure with minimal direction</li> <li>○ Removes gallbladder from liver bed without injuring either structure</li> </ul> </li> </ul>  |
| <p><b>Level 4</b> <i>Adapts tissue handling based on tissue quality</i></p> <p><i>Visualizes tissue plane, identifies and dissects relevant abnormal anatomy</i></p> <p><i>Adapts to unexpected findings and events during the course of the operation</i></p>  | <ul style="list-style-type: none"> <li>● Examples in laparoscopic cholecystectomy:                             <ul style="list-style-type: none"> <li>○ Adapts tissue handling for acute/gangrenous cholecystitis</li> <li>○ Recognizes aberrant biliary anatomy and adapts dissection without direction</li> </ul> </li> </ul>   |

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| <p><b>Level 5</b> <i>Identifies innovative operative techniques, instrumentation, operative approaches, or significant improvement in established techniques</i></p> | <ul style="list-style-type: none"> <li>● Brings natural orifice approach to his or her institution</li> </ul>  |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation evaluation</li> <li>● Simulation</li> <li>● Video review</li> </ul>   |
| <p>Curriculum Mapping</p>  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>  | <ul style="list-style-type: none"> <li>● Laparoscopic cholecystectomy and inguinal hernia are used as examples. The same concepts should be applied to a variety of operations.</li> <li>● Fundamentals of Endoscopic Surgery. <a href="http://www.fesprogram.org/">http://www.fesprogram.org/</a>. 2020.</li> <li>● Fundamentals of Laparoscopic Surgery. <a href="https://www.flprogram.org/">https://www.flprogram.org/</a>. 2020.</li> </ul> |

| <b>Medical Knowledge 1: Cardiovascular Surgical Knowledge</b>  |   |
|--|---|
| <b>Overall Intent:</b> To demonstrate comprehensive knowledge of anatomy, physiology, and pathophysiology related to cardiovascular surgery  |   |
| <b>Milestones</b>  | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Identifies normal cardiovascular anatomy</i></p> <p><i>Identifies normal cardiovascular physiology</i></p> <p><i>Lists components of cardiopulmonary bypass apparatus</i></p>   | <ul style="list-style-type: none"> <li>● Identifies coronary anatomy, valve relationships, and location of conduction system</li> <li>● Identifies determinates of cardiac output, analyzing swan waveform</li> <li>● Lists oxygenator, pump heads, heat exchanger, low level alarm, and in-line monitoring</li> </ul>  |
| <p><b>Level 2</b> <i>Identifies variants of cardiovascular anatomy</i></p> <p><i>Identifies cardiovascular pathophysiology</i></p> <p><i>Demonstrates knowledge of cardioplegia solutions, delivery modes, and complications of bypass</i></p>           | <ul style="list-style-type: none"> <li>● Identifies abnormal coronary anatomy (e.g., stenotic vessel, intramyocardial segment) and bicuspid aortic valve</li> <li>● Evaluates electrocardiogram (EKG) for ST-elevation myocardial infarction (STEMI) and diagnoses atrial fibrillation</li> <li>● Understands difference in crystalloid and blood cardioplegia, describes antegrade and retrograde, and coagulopathy</li> </ul> |
| <p><b>Level 3</b> <i>Integrates knowledge of anatomy with diagnostic testing</i></p> <p><i>Integrates knowledge of pathophysiology with diagnostic testing</i></p> <p><i>Discusses cannulation techniques and options for cardiopulmonary bypass</i></p> | <ul style="list-style-type: none"> <li>● Identifies coronary anatomy on various angiographic views, and valvular anatomy on echo</li> <li>● Identifies systolic anterior motion on echocardiogram, and appropriately describes regurgitant jets in valvular insufficiency</li> <li>● Explains single venous versus bicaval, central versus peripheral arteries, and cold versus full or partial</li> </ul>                      |
| <p><b>Level 4</b> <i>Integrates knowledge of anatomical changes after prior surgery with diagnostic testing</i></p> <p><i>Integrates knowledge of pathophysiologic changes after prior surgery with diagnostic testing</i></p>                           | <ul style="list-style-type: none"> <li>● Recognizes bypass grafts on angiogram, type of valve replacement on imaging, and proximity of cardiac anatomy to sternum prior to redo-sternotomy</li> <li>● Recognizes paravalvular leak on echo, cardiac tamponade on imaging, and hemodynamic data</li> </ul>   |

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| <i>Explains management strategies of complex complications related to cardiopulmonary bypass</i>                    | <ul style="list-style-type: none"> <li>● Can list the steps required to manage iatrogenic aortic dissection or air embolism</li> </ul>  |
| <b>Level 5</b> <i>Uses advanced imaging techniques to help identify anatomic variability for operative planning</i> | <ul style="list-style-type: none"> <li>● Uses 3D modeling and/or reconstruction for planning</li> </ul>   |
| <i>Contributes to medical literature</i>  | <ul style="list-style-type: none"> <li>● Participates in writing a book chapter or review article</li> </ul>  |
| Assessment Models or Tools  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● End-of-rotation evaluation</li> <li>● Learn CT Surgery Benchmark quizzes</li> <li>● Mock orals</li> <li>● Simulation</li> <li>● TSDA in-service exam</li> </ul>  |
| Curriculum Mapping  | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| Notes or Resources  | <ul style="list-style-type: none"> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> <li>● Self Education Self Assessment in Thoracic Surgery (SESATS). <a href="http://www.sesats.org/">http://www.sesats.org/</a>. 2020.</li> </ul> |

| <b>Medical Knowledge 2: General Thoracic Surgical Knowledge</b>  |   |
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| <b>Overall Intent:</b> To demonstrate comprehensive knowledge of anatomy, physiology, and pathophysiology related to general thoracic surgery  |   |
| <b>Milestones</b>  | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Identifies normal general thoracic anatomy</i></p> <p><i>Identifies normal general thoracic physiology</i></p>  | <ul style="list-style-type: none"> <li>● Lists the bronchopulmonary segments of the lung</li> <li>● Identifies the compartments of the mediastinum and its components</li> <li>● Identifies normal location of recurrent and phrenic nerves</li> <li>● Describes the blood supply of the foregut</li> <li>● Describes the physiology of gas exchange in the lung</li> <li>● Describes normal esophageal motility</li> </ul>                   |
| <p><b>Level 2</b> <i>Identifies variants of general thoracic anatomy</i></p> <p><i>Identifies general thoracic pathophysiology and staging of thoracic malignancies</i></p>  | <ul style="list-style-type: none"> <li>● Describes the variations of left upper lobe pulmonary artery anatomy</li> <li>● Identifies bronchial suis</li> <li>● Describes esophageal motility disorders</li> <li>● Describes the physiology of chronic obstructive pulmonary disease (COPD) and physiology of pulmonary fibrosis</li> <li>● Explains the TNM (Tumor, Nodes, Metastases) staging of lung cancer and esophageal cancer</li> </ul> |
| <p><b>Level 3</b> <i>Integrates knowledge of anatomy with diagnostic testing</i></p> <p><i>Integrates knowledge of pathophysiology with diagnostic testing</i></p>   | <ul style="list-style-type: none"> <li>● Identifies mediastinal lymph node stations on CT imaging</li> <li>● Identifies segments and lobes of the lung on CT imaging</li> <li>● Identifies abnormal patterns on esophageal manometry</li> <li>● Identifies high-risk patients for pulmonary resection based on pulmonary function tests</li> </ul>  |
| <p><b>Level 4</b> <i>Integrates knowledge of anatomical changes after prior surgery with diagnostic testing</i></p> <p><i>Integrates knowledge of pathophysiologic changes after prior surgery with diagnostic testing</i></p> | <ul style="list-style-type: none"> <li>● Identifies previous pulmonary resections on CT imaging</li> <li>● Identifies prior Nissen fundoplication on esophagram</li> <li>● Identifies failed Nissen on barium studies</li> <li>● Interprets pulmonary function tests in the setting of prior pulmonary resection</li> </ul>   |
| <p><b>Level 5</b> <i>Uses advanced imaging techniques to help identify anatomic variability for operative planning</i></p> <p><i>Contributes to medical literature</i></p>   | <ul style="list-style-type: none"> <li>● Uses 3D reconstruction imaging to plan for surgery (tracheal resection, chest wall surgery, Pancoast tumors)</li> </ul>  |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Chart review</li> <li>● Direct observation</li> </ul>  |

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|                    | <ul style="list-style-type: none"><li>● Learn CT Surgery Benchmark quizzes</li><li>● Mock orals</li><li>● TSDA in-service exam</li></ul>  |
| Curriculum Mapping | <ul style="list-style-type: none"><li>●</li></ul>   |
| Notes or Resources | <ul style="list-style-type: none"><li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li><li>● SESATS. <a href="http://www.sesats.org/">http://www.sesats.org/</a>. 2020.</li></ul> |

| <b>Medical Knowledge 3: Congenital Heart Disease</b>  |  |
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| <b>Overall Intent:</b> To demonstrate understanding and knowledge of congenital heart disease   |  |
| <b>Milestones</b>   | <b>Examples</b>  |
| <b>Level 1</b> <i>Demonstrates knowledge of embryology, anatomy, and physiology related to routine forms of congenital heart disease</i>      | <ul style="list-style-type: none"> <li>● Demonstrates knowledge of embryology, anatomy, and physiology of atrial septal defect (ASD), VSD, patent ductus arteriosus (PDA), or coarctation</li> </ul>   |
| <b>Level 2</b> <i>Demonstrates knowledge of embryology, anatomy, and physiology related to complex forms of congenital heart disease</i>      | <ul style="list-style-type: none"> <li>● Demonstrates knowledge of embryology, anatomy, and physiology of truncus arteriosus, transposition of the great vessels, tetralogy of Fallot, hypoplastic left heart syndrome, atrioventricular canal defects, total anomalous pulmonary venous return (TAPVR), or partial anomalous pulmonary venous return (PAPVR)</li> </ul> |
| <b>Level 3</b> <i>Demonstrates knowledge of operative principles and non-operative options for routine forms of congenital heart disease</i>  | <ul style="list-style-type: none"> <li>● Demonstrates knowledge of operative principles and non-operative options for ASD, VSD, PDA, or coarctation</li> </ul>   |
| <b>Level 4</b> <i>Demonstrates knowledge of operative principles and non-operative options for complex forms of congenital heart disease</i>  | <ul style="list-style-type: none"> <li>● Demonstrates knowledge of operative principles and non-operative options for Tetralogy of Fallot, AV canal defects, TAPVR, or PAPVR</li> </ul>  |
| <b>Level 5</b> <i>Demonstrates knowledge of operative principles and non-operative options for advanced forms of congenital heart disease</i> | <ul style="list-style-type: none"> <li>● Demonstrates knowledge of operative principles and non-operative options for re-operative congenital heart surgery, tetralogy of Fallot with pulmonary atresia, truncus, hypoplastic left heart syndrome, transposition, interrupted aortic arch, or heart transplant in a patient with single ventricle physiology</li> </ul>  |
| Assessment Models or Tools  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Mock orals</li> <li>● TSDA in-service exam</li> </ul>   |
| Curriculum Mapping  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| Notes or Resources  | <ul style="list-style-type: none"> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> </ul>   |

| <b>Systems-Based Practice 1: Patient Safety and Quality Improvement (QI)</b>   |  |
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| <b>Overall Intent:</b> To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals; to conduct a QI project   |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Demonstrates knowledge of common patient safety events</i></p> <p><i>Demonstrates knowledge of how to report patient safety events</i></p> <p><i>Demonstrates knowledge of basic quality improvement methodologies and metrics</i></p>                        | <ul style="list-style-type: none"> <li>● Lists patient misidentification or medication errors as common patient safety events</li> <li>● Describes how to report errors in your environment</li> <li>● Describes Society of Thoracic Surgeons (STS) database, National Surgery Quality Improvement Program, and root cause analysis</li> <li>● Participates in a morbidity and mortality (M and M) conference</li> </ul>   |
| <p><b>Level 2</b> <i>Identifies system factors that lead to patient safety events</i></p> <p><i>Reports patient safety events to superiors/faculty members</i></p> <p><i>Describes local quality improvement initiatives</i></p>   | <ul style="list-style-type: none"> <li>● Identifies that lack of hand sanitizer dispenser at each clinical exam room may lead to increased infection rates; identifies that outpatient medications are not reconciled to inpatient medications</li> <li>● Reports lack of hand sanitizer dispenser at each clinical exam room to appropriate supervisor</li> <li>● Summarizes protocols resulting in decreased spread of hospital acquired <i>C. diff</i></li> </ul>         |
| <p><b>Level 3</b> <i>Participates in analysis of patient safety events (simulated or actual)</i></p> <p><i>Reports patient safety events through institutional reporting systems (actual or simulated)</i></p> <p><i>Participates in local quality improvement initiatives</i></p> | <ul style="list-style-type: none"> <li>● Preparing for M and M presentations or participates in data entry for quality assurance (QA) database</li> <li>● Through simulation, communicates with patients/families about a medication administration error</li> <li>● Participates in project identifying root cause of operating room turnover inefficiency, leads M and M case, or participates on a quality committee</li> </ul>   |
| <p><b>Level 4</b> <i>Conducts analysis of patient safety events and offers error prevention strategies (simulated or actual)</i></p> <p><i>Participates in disclosure of patient safety events to patients and families (simulated or actual)</i></p>                              | <ul style="list-style-type: none"> <li>● Collaborates with a team to conduct the analysis of a medication administration errors and effectively communicates with patients/families about those events</li> <li>● Participates in the completion of a QI project, including assessing the problem, articulating a broad goal, developing a SMART (Specific, Measurable, Attainable, Realistic, Time-Based) objective plan, and monitoring progress and challenges</li> </ul> |



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| <p><i>Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project</i></p>   |   |
| <p><b>Level 5</b> <i>Actively engages teams and processes to modify systems to prevent patient safety events</i></p> <p><i>Role models or mentors others in the reporting/disclosure of patient safety events to superiors/organization</i></p> <p><i>Creates, implements, and assesses quality improvement initiatives at the institutional or community level</i></p> | <ul style="list-style-type: none"> <li>● Assumes a leadership role at the departmental or institutional level for patient safety</li> <li>● Conducts a simulation for disclosing patient safety events</li> <li>● Initiates and completes a QI project at hospital, county, or state level</li> </ul>   |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● E-module multiple choice tests</li> <li>● Medical record (chart) audit</li> <li>● Multisource feedback</li> <li>● Portfolio</li> <li>● Reflection</li> <li>● Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● Institute of Healthcare Improvement. <a href="http://www.ihl.org/Pages/default.aspx">http://www.ihl.org/Pages/default.aspx</a>. 2020.</li> <li>● STS Database. <a href="http://www.sts.org">www.sts.org</a>. 2020.</li> <li>● Gallagher T, Studdert D, Levinson W. Disclosing harmful medical errors to patients. <i>N Engl J Med</i>. 2007;356(26):2713-2719. <a href="https://www.nejm.org/doi/full/10.1056/NEJMra070568?url_ver=Z39.88-2003&amp;rfr_id=ori:rid:crossref.org&amp;rfr_dat=cr_pub%3dpubmed">https://www.nejm.org/doi/full/10.1056/NEJMra070568?url_ver=Z39.88-2003&amp;rfr_id=ori:rid:crossref.org&amp;rfr_dat=cr_pub%3dpubmed</a>. 2020.</li> <li>● Gallagher TH, Etchegaray JM, Bergstedt B, et al. Improving communication and resolution following adverse events using a patient-created simulation exercise. <i>Health Serv Res</i>. 2016;51(6):2537-2549. <a href="https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-6773.12601">https://onlinelibrary.wiley.com/doi/abs/10.1111/1475-6773.12601</a>. 2020.</li> </ul> |

| <b>Systems-Based Practice 2: System Navigation for Patient-Centered Care</b>  |   |
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| <b>Overall Intent:</b> To effectively navigate the health care system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes  |   |
| <b>Milestones</b>   | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Demonstrates knowledge of care coordination</i></p> <p><i>Identifies key elements for safe and effective transitions of care and hand-offs</i></p> <p><i>Demonstrates knowledge of population and community health needs and disparities</i></p>   | <ul style="list-style-type: none"> <li>● For a patient with lung cancer requiring adjuvant therapy, identifies need for communication with medical oncologist and/or radiation oncologist</li> <li>● Lists the essential components of a structured sign-out tool during care transitions and hand-offs</li> <li>● Identifies information a medical oncologist may need to determine care and methods of delivering that information</li> <li>● Identifies that patients in rural areas may have different needs and access to a medical oncologist/radiation oncologist than urban patients</li> </ul> |
| <p><b>Level 2</b> <i>Coordinates care of patients in routine clinical/social situations effectively using the roles of the interprofessional teams</i></p> <p><i>Performs safe and effective transitions of care/hand-offs in routine clinical situations</i></p> <p><i>Identifies specific population and community health needs and inequities for their local population</i></p> | <ul style="list-style-type: none"> <li>● Coordinates care with the heart failure clinic at the time of discharge from the hospital</li> <li>● Routinely uses a structured sign-out tool for a stable patient during night float sign-out</li> <li>● Identifies that limited transportation options may be a factor in rural patients getting to multiple chemotherapy appointments</li> </ul>   |
| <p><b>Level 3</b> <i>Coordinates care of patients in complex clinical/social situations effectively using the roles of the interprofessional teams</i></p> <p><i>Performs safe and effective transitions of care/hand-offs in complex clinical situations</i></p> <p><i>Uses local resources effectively to meet the needs of a patient population and community</i></p>            | <ul style="list-style-type: none"> <li>● Works with the social worker to coordinate care for a homeless patient that will ensure follow-up to a heart failure clinic after discharge from the hospital</li> <li>● Routinely uses a structured sign-out tool when transferring a patient to the ICU</li> <li>● Makes appropriate referral for patients who cannot afford post discharge medication</li> </ul>  |
| <p><b>Level 4</b> <i>Role models effective coordination of patient-centered care among different disciplines and specialties</i></p>  | <ul style="list-style-type: none"> <li>● Leads team members in approaching interdisciplinary approach to patient care</li> </ul>  |

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| <p><i>Role models and advocates for safe and effective transitions of care/hand-offs within and across health care delivery systems</i></p> <p><i>Adapts personal practice to provide for the needs of specific populations</i></p>   | <ul style="list-style-type: none"> <li>● Prior to going on vacation, proactively informs the covering resident about a plan of care for a patient with a complex wound</li> <li>● Adapts pain management plan in the context of substance use disorder</li> </ul>   |
| <p><b>Level 5</b> <i>Analyzes the process of care coordination and leads in the design and implementation of improvements</i></p> <p><i>Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes</i></p> <p><i>Leads innovations and advocates for populations and communities with health care inequities</i></p> | <ul style="list-style-type: none"> <li>● Leads a program to streamline the process for discharge with home oxygen</li> <li>● Develops a protocol to improve transitions to long-term care facilities</li> <li>● Leads development of telehealth diagnostic services for a rural site</li> </ul>   |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Medical record (chart) audit</li> <li>● Multisource feedback</li> <li>● Quality metrics and goals mined from electronic health records (EHRs)</li> <li>● Review of sign-out tools, use and review of checklists</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● CDC. Population Health Training in Place Program (PH-TIPP). <a href="https://www.cdc.gov/pophealthtraining/whatis.html">https://www.cdc.gov/pophealthtraining/whatis.html</a>. 2020.</li> <li>● Kaplan KJ. In pursuit of patient-centered care. <a href="http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns">http://tissuepathology.com/2016/03/29/in-pursuit-of-patient-centered-care/#axzz5e7nSsAns</a>. 2020.</li> <li>● Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan JM, Gonzalo JD. <i>AMA Education Consortium: Health Systems Science</i>. Philadelphia, PA: Elsevier; 2016. <a href="https://commerce.ama-assn.org/store/ui/catalog/productDetail?product_id=prod2780003">https://commerce.ama-assn.org/store/ui/catalog/productDetail?product_id=prod2780003</a>. 2020.</li> </ul> |

| <b>Systems-Based Practice 3: Physician Role in Health Care Systems</b>  |   |
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| <b>Overall Intent:</b> To understand the physician’s role in the complex health care system and how to optimize the system to improve patient care and the health system’s performance  |   |
| <b>Milestones</b>   | <b>Examples</b>   |
| <p><b>Level 1</b> <i>Identifies key components of the complex health care system</i></p> <p><i>Describes basic health payment systems, including practice models</i></p> <p><i>Identifies basic knowledge domains for effective transition to practice</i></p>  | <ul style="list-style-type: none"> <li>● Articulates differences between skilled nursing and long-term care facilities</li> <li>● Understands the impact of health plan coverage on prescription drugs for individual patients</li> <li>● Identifies that notes must meet coding requirements</li> </ul>  |
| <p><b>Level 2</b> <i>Describes how components of a complex health care system are interrelated, and how this impacts patient care</i></p> <p><i>Delivers care with consideration of each patient’s payment model</i></p> <p><i>Demonstrates use of information technology required for medical practice</i></p> | <ul style="list-style-type: none"> <li>● Explains that improving patient satisfaction impacts patient adherence and payment to the health system</li> <li>● Takes into consideration patient’s prescription drug coverage when choosing a statin for treatment of hyperlipidemia</li> <li>● Recognizes that appropriate documentation can influence the severity of illness determination upon discharge</li> </ul> |
| <p><b>Level 3</b> <i>Discusses how individual practice affects the broader system</i></p> <p><i>Engages with patients in shared decision making, informed by each patient’s payment models</i></p> <p><i>Describes core administrative knowledge needed for transition to practice</i></p>                      | <ul style="list-style-type: none"> <li>● Ensures that patient with COPD has a scheduled follow up appointment at discharge within seven days to reduce risk of readmission</li> <li>● Discusses costs and benefits of the location of surveillance imaging post-cancer resection</li> <li>● Understands the core elements of employment contract negotiation</li> </ul>   |
| <p><b>Level 4</b> <i>Manages and adapts personal practice to provide efficient and effective patient care and transition of care</i></p> <p><i>Advocates for patient care needs with consideration of the limitations of each patient’s payment model</i></p>   | <ul style="list-style-type: none"> <li>● Ensures proper documentation of three-day qualifying hospital stay prior to discharging a patient to a skilled nursing facility for physical therapy</li> <li>● Works collaboratively to improve patient assistance resources for a patient with a recent amputation and limited resources</li> </ul>  |

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| <p><i>Analyzes practice patterns and professional requirements in preparation for practice</i></p>  | <ul style="list-style-type: none"> <li>● Proactively compiles procedure log in anticipation of applying for hospital privileges</li> </ul>   |
| <p><b>Level 5</b> <i>Advocates for or leads systems change that enhances efficient and effective patient care and transition of care</i></p> <p><i>Participates in health policy advocacy activities</i></p> <p><i>Educates others to prepare them for transition to practice</i></p> | <ul style="list-style-type: none"> <li>● Works with community or professional organizations to advocate for no smoking ordinances</li> <li>● Improves informed consent process for non-English-speaking patients requiring interpreter services</li> </ul>   |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Medical record (chart) audit</li> <li>● Multisource feedback</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● Agency for Healthcare Research and Quality (AHRQ). Measuring the Quality of Physician Care. <a href="https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/challenges.html">https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/challenges.html</a>. 2020.</li> <li>● AHRQ. Major physician performance sets. <a href="https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/measurementsets.html">https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/measurementsets.html</a>. 2020.</li> <li>● The Kaiser Family Foundation. <a href="http://www.kff.org">www.kff.org</a>. 2020.</li> <li>● The Kaiser Family Foundation: Topic: health reform. <a href="https://www.kff.org/topic/health-reform/">https://www.kff.org/topic/health-reform/</a>. 2020.</li> <li>● Dzau VJ, McClellan M, Burke S, et al. Vital directions for health and health care: priorities from a National Academy of Medicine Initiative. <i>NAM Perspectives</i>. Discussion Paper, National Academy of Medicine, Washington, DC. <a href="https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/">https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/</a>. 2020.</li> <li>● The Commonwealth Fund. Health System Data Center. <a href="http://datacenter.commonwealthfund.org/?_ga=2.110888517.1505146611.1495417431-1811932185.1495417431#ind=1/sc=1">http://datacenter.commonwealthfund.org/?_ga=2.110888517.1505146611.1495417431-1811932185.1495417431#ind=1/sc=1</a>. 2020.</li> <li>● The Commonwealth Fund. Health Reform Resource Center. <a href="http://www.commonwealthfund.org/interactives-and-data/health-reform-resource-center#/f:@facasubcategoriesfacet63677=[Individual%20and%20Employer%20Responsibility">http://www.commonwealthfund.org/interactives-and-data/health-reform-resource-center#/f:@facasubcategoriesfacet63677=[Individual%20and%20Employer%20Responsibility</a>. 2020.</li> </ul> |

| <b>Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice</b><br><b>Overall Intent:</b> To incorporate evidence and patient values into clinical practice |   |
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| Milestones   | Examples  |
| <b>Level 1</b> <i>Demonstrates how to access and use available evidence to take care of a routine patient</i>  | <ul style="list-style-type: none"> <li>● Looks up disease-specific STS guidelines</li> </ul>  |
| <b>Level 2</b> <i>Articulates clinical questions and elicits patient preferences and values in order to guide evidence-based care</i>  | <ul style="list-style-type: none"> <li>● Discusses role of bioprosthetic versus mechanical valve replacement with patients</li> <li>● Discusses role of stereotactic body radiation therapy (SBRT) versus surgery for early stage lung cancer with patients</li> </ul>  |
| <b>Level 3</b> <i>Locates and applies the best available evidence, integrated with patient preference, to the care of complex patients</i>   | <ul style="list-style-type: none"> <li>● Discusses National Comprehensive Cancer Network guidelines for N2 positive lung cancer</li> <li>● Discusses role of adjuvant therapy after lung cancer resection</li> </ul>  |
| <b>Level 4</b> <i>Critically appraises and applies evidence even in the face of uncertainty and conflicting evidence to guide care, tailored to the individual patient</i>         | <ul style="list-style-type: none"> <li>● Discusses anticoagulation indications after valve replacement</li> <li>● Discusses treatment options for Stage 3A lung cancer</li> </ul>   |
| <b>Level 5</b> <i>Coaches others to critically appraise and apply evidence for complex patients; and/or participates in the development of guidelines</i>                          | <ul style="list-style-type: none"> <li>● Leads local development of enhanced recovery from surgery protocols</li> </ul>   |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>● Conference presentations</li> <li>● Direct observation</li> <li>● M and M</li> <li>● Oral or written examinations</li> </ul>   |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| Notes or Resources   | <ul style="list-style-type: none"> <li>● National Institutes of Health. U.S. National Library of Medicine. Write Your Application. <a href="https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm">https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm</a>. 2020.</li> <li>● National Institutes of Health. U.S. National Library of Medicine. PubMed Tutorial. <a href="https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html">https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html</a>. 2020.</li> <li>● Institutional IRB guidelines</li> <li>● National Comprehensive Cancer Network Guidelines. <a href="http://www.nccn.org">www.nccn.org</a>. 2020.</li> <li>● American College of Cardiology Guidelines. <a href="https://www.acc.org/guidelines">https://www.acc.org/guidelines</a>. 2020.</li> <li>● STS Guidelines. <a href="https://www.sts.org/resources/clinical-practice-credentialing-and-reporting-guidelines">https://www.sts.org/resources/clinical-practice-credentialing-and-reporting-guidelines</a>. 2020.</li> </ul> |

| <b>Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Personal Growth</b>  |   |
|--|---|
| <b>Overall Intent:</b> To seek clinical performance information with the intent to improve care; reflects on all domains of practice, personal interactions, and behaviors, and their impact on colleagues and patients (reflective mindfulness); develop clear objectives and goals for improvement in some form of a learning plan |   |
| Milestones   | Examples  |
| <b>Level 1</b> <i>Accepts responsibility for personal and professional development by establishing goals and actively seeking opportunities to improve</i>   | <ul style="list-style-type: none"> <li>● Sets a personal practice goal of improving suture management</li> <li>● Identifies gaps in knowledge of ischemic heart disease</li> <li>● Asks for feedback from patients, families, and patient care team members</li> </ul>  |
| <b>Level 2</b> <i>When prompted, uses performance data to identify gaps, design, and implement a learning plan</i>   | <ul style="list-style-type: none"> <li>● When prompted, uses in-training exam results to identify areas for improvement</li> <li>● When prompted, develops reading plan based on identified areas for improvement</li> </ul>  |
| <b>Level 3</b> <i>Independently uses performance data to identify gaps, design, and implement a learning plan</i>  | <ul style="list-style-type: none"> <li>● Uses in-training exam and multisource feedback results to identify areas for improvement</li> <li>● Implements reading plan based on identified areas for improvement</li> </ul>   |
| <b>Level 4</b> <i>Independently uses performance data to measure the effectiveness of the learning plan and adapt the plan as needed</i>   | <ul style="list-style-type: none"> <li>● Evaluates performance on subsequent in-training exams and adjusts study plan appropriately</li> </ul>  |
| <b>Level 5</b> <i>Facilitates the design and implementing learning plans for others</i>  | <ul style="list-style-type: none"> <li>● Assists first-year residents in developing their individualized learning plans</li> </ul>  |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Review of learning plan</li> </ul>   |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| Notes or Resources   | <ul style="list-style-type: none"> <li>● Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. <i>Acad Med.</i> 2009;84(8):1066-74. <a href="https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians_Lifelong.21.aspx">https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians_Lifelong.21.aspx</a>. 2020.</li> <li>● Burke AE, Benson B, Englander R, Carraccio C, Hicks PJ. Domain of competence: practice-based learning and improvement. <i>Acad Pediatr.</i> 2014;14: S38-S54. <a href="https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/pdf">https://www.academicpedsjnl.net/article/S1876-2859(13)00333-1/pdf</a>. 2020.</li> <li>● Lockspeiser TM, Schmitter PA, Lane JL et al. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. <i>Acad Med.</i> 2013;88(10)1558-63. <a href="https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents_Written_Learning_Goals_and.39.aspx">https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents_Written_Learning_Goals_and.39.aspx</a>. 2020.</li> <li>● STS. <a href="https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum">https://www.sts.org/online-learning/sts-thoracic-surgical-curriculum</a>. 2021</li> <li>● SESATS. <a href="http://www.sesats.org/">http://www.sesats.org/</a>. 2020.</li> <li>● TSDA. TSDA In-Training Exam. <a href="https://tsda.org/in-training-exam/">https://tsda.org/in-training-exam/</a>. 2020.</li> </ul> |



| <b>Professionalism 1: Ethical Principles</b>   |   |
|--|---|
| <b>Overall Intent:</b> To recognize and address lapses in ethical and professional behavior, demonstrates ethical and professional behaviors, and use appropriate resources for managing ethical and professional dilemmas                 |   |
| <b>Milestones</b>  | <b>Examples</b>   |
| <b>Level 1</b> <i>Demonstrates knowledge of the ethical principles underlying informed consent, surrogate decision making, advance directives, confidentiality, error disclosure, stewardship of limited resources, and related topics</i> | <ul style="list-style-type: none"> <li>● Discusses the basic principles of beneficence, nonmaleficence, justice, autonomy</li> <li>● Discusses professional values and commitments and how they apply to informed consent process</li> <li>● Lists elements of informed consent for procedures</li> </ul>   |
| <b>Level 2</b> <i>Applies ethical principles during patient care</i>   | <ul style="list-style-type: none"> <li>● Identifies surrogate for impaired patients</li> <li>● Maintains patient confidentiality in public situations</li> </ul>  |
| <b>Level 3</b> <i>Recognizes need to seek help in managing and resolving ethical situations</i>  | <ul style="list-style-type: none"> <li>● Obtains institutional guidance on obtaining consent for blood transfusion in pediatric Jehovah’s Witness patient</li> <li>● Analyzes difficult real or hypothetical ethics case scenarios or situations, recognizes own limitations</li> </ul>   |
| <b>Level 4</b> <i>Uses appropriate resources for managing and resolving ethical dilemmas as needed</i>   | <ul style="list-style-type: none"> <li>● Manages a near miss or sentinel event by contacting risk management</li> <li>● Identifies ethical dilemmas of performing procedures in patients who are potential organ donors</li> <li>● Recognizes and manages situations of medical futility</li> </ul>   |
| <b>Level 5</b> <i>Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution</i>   | <ul style="list-style-type: none"> <li>● Identifies and seeks to address system-wide factors or barriers to promoting a culture of ethical behavior through participation in a work group, committee, or task force</li> </ul>  |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Global evaluation</li> <li>● Multisource feedback</li> <li>● Oral or written self-reflection</li> <li>● Simulation</li> </ul>  |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| Notes or Resources   | <ul style="list-style-type: none"> <li>● American Medical Association. Ethics. <a href="https://www.ama-assn.org/delivering-care/ama-code-medical-ethics">https://www.ama-assn.org/delivering-care/ama-code-medical-ethics</a>. 2020.</li> <li>● Byyny RL, Papadakis MA, Paauw DS. <i>Medical Professionalism Best Practices</i>. Menlo Park, CA: Alpha Omega Alpha Medical Society; 2015. <a href="https://alphaomegaaalpha.org/pdfs/2015MedicalProfessionalism.pdf">https://alphaomegaaalpha.org/pdfs/2015MedicalProfessionalism.pdf</a>. 2020.</li> <li>● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. <i>Understanding Medical Professionalism</i>. 1st ed. New York, NY: McGraw-Hill Education; 2014.</li> </ul> |



- 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. <http://alphaomegalpha.org/pdfs/Monograph2018.pdf>. 2020.
- STS. Code of Ethics. <https://www.sts.org/about-sts/policies/code-ethics>. 2020.
- American Association for Thoracic Surgery (AATS). Code of Ethics. <https://www.aats.org/aatsimis/AATSWeb/Association/About/Governance/By-Laws and Policies/Code of Ethics.aspx>. 2020.

| <b>Professionalism 2: Professional Behavior and Accountability</b>   |  |
|--|--|
| <b>Overall Intent:</b> To take responsibility for their actions and the impact on patients and other members of the health care team and recognize limits of one’s own knowledge and skill   |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <p><b>Level 1</b> <i>Completes patient care tasks and responsibilities, identifies potential barriers, and describes strategies for ensuring timely task completion</i></p> <p><i>Describes when and how to appropriately report lapses in professional behavior</i></p> <p><i>Accepts feedback highlighting gaps</i></p>                        | <ul style="list-style-type: none"> <li>● Completes routine discharge process</li> <li>● Sees transfer patient and completes admit orders in a timely manner</li> <br/> <li>● Knows how to report unprofessional behavior at their institution</li> <br/> <li>● Acknowledges gaps in skill during a case debriefing and spends additional time in the simulation lab</li> </ul>   |
| <p><b>Level 2</b> <i>Performs patient care tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations</i></p> <p><i>Takes responsibility for his or her own professional behavior and reports lapses in self and others</i></p> <p><i>Episodically seeks feedback</i></p>                          | <ul style="list-style-type: none"> <li>● Consents patient and schedules lobectomy</li> <br/> <li>● Apologizes to team member(s) for unprofessional behavior without prompting</li> <br/> <li>● Recognizes difficulty placing chest tube and requests feedback before next procedure</li> </ul>   |
| <p><b>Level 3</b> <i>Performs patient care tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations</i></p> <p><i>Demonstrates professional behavior in complex or stressful situations</i></p> <p><i>Intentionally seeks and integrates multisource feedback into practice</i></p> | <ul style="list-style-type: none"> <li>● Counsels angry patient with complaints about care team while having multiple other clinical responsibilities</li> <br/> <li>● Asks for help after attempting central line twice without success</li> <li>● Asks for help when unable to identify critical pulmonary anatomy</li> <br/> <li>● Asks for help leading family meeting where withdrawal of life-sustaining treatment will be discussed</li> <li>● Consistently integrates intra-operative feedback into performance improvement</li> </ul> |

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|---|---|
| <p><b>Level 4</b> <i>Recognizes situations that may impact others' ability to complete patient-care tasks and responsibilities in a timely manner</i></p> <p><i>Intervenes to prevent and correct lapses in professional behavior in self and others</i></p> <p><i>Provides constructive feedback to others</i></p> | <ul style="list-style-type: none"> <li>● Adjusts junior resident schedule to allow work hour compliance</li> <li>● Encourages junior residents to use well-being days</li> <br/> <li>● Asks another team member to perform tasks when fatigued</li> <li>● Reports student harassment to appropriate institutional official</li> </ul>   |
| <p><b>Level 5</b> <i>Develops systems to enhance other's ability to efficiently complete patient-care tasks and responsibilities</i></p> <p><i>Coaches others when their behavior fails to meet professional expectations</i></p>   | <ul style="list-style-type: none"> <li>● Sets up a meeting with the nurse manager to streamline patient discharges</li> <li>● Shares templates for documentation</li> <br/> <li>● Coaches others on how to avoid conflict with team members</li> </ul>  |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Compliance with deadlines and timelines</li> <li>● Direct observation</li> <li>● Multisource feedback</li> <li>● Self-evaluations</li> <li>● Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● American College of Surgeons. Code of Professional Conduct <a href="https://www.facs.org/about-acf/statements/stonprin#code">https://www.facs.org/about-acf/statements/stonprin#code</a>. 2020.</li> <li>● Code of conduct from institutional manual</li> <li>● STS. Code of Ethics. <a href="https://www.sts.org/about-sts/policies/code-ethics">https://www.sts.org/about-sts/policies/code-ethics</a>. 2020.</li> <li>● AATS. Code of Ethics. <a href="https://www.aats.org/aatsimis/AATSWeb/Association/About/Governance/By-Laws%20and%20Policies/Code%20of%20Ethics.aspx">https://www.aats.org/aatsimis/AATSWeb/Association/About/Governance/By-Laws and Policies/Code of Ethics.aspx</a>. 2020.</li> </ul> |

| <b>Professionalism 3: Administrative Tasks</b>  |  |
|---|--|
| <b>Overall Intent:</b> To ensure the resident develops the skills and behaviors required to complete the administrative duties of being a surgeon, such as clinical work and education hours, Case Logs, evaluations, discharge summaries, operative reports, daily progress notes, and conference/meeting attendance |  |
| <b>Milestones</b>   | <b>Examples</b>  |
| <b>Level 1</b> <i>Takes responsibility for failure to complete administrative tasks and responsibilities</i>  | <ul style="list-style-type: none"> <li>● When a program director confronts a resident who has failed to concurrently log cases, the resident acknowledges failure to allocate time specifically for this administrative duty</li> <li>● Creates a plan to log all cases at the end of every day</li> </ul>   |
| <b>Level 2</b> <i>Performs administrative tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations</i>  | <ul style="list-style-type: none"> <li>● Logs clinical and educational work hours and Case Logs regularly</li> <li>● Completes operative report or discharge summary dictation promptly</li> <li>● Responds to pages, texts, and emails</li> </ul>   |
| <b>Level 3</b> <i>Performs administrative tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations</i>   | <ul style="list-style-type: none"> <li>● When on a busy service, continues to log clinical and educational work hours and cases without interruption</li> <li>● Completes timely evaluations while having multiple clinical responsibilities</li> </ul>  |
| <b>Level 4</b> <i>Recognizes situations that may impact others' ability to complete administrative tasks and responsibilities in a timely manner</i>  | <ul style="list-style-type: none"> <li>● A resident who has planned to attend a wedding in the family makes the appropriate changes in the call schedule to avoid service interruptions</li> <li>● A senior resident anticipates junior resident rotation changes and ensures that patient documentation is completed</li> </ul>                       |
| <b>Level 5</b> <i>Develops systems to enhance other's ability to efficiently complete administrative tasks and responsibilities</i>   | <ul style="list-style-type: none"> <li>● Works with the hospital information technology department to develop a resident shared file directory to facilitate resident completion of administrative requirements such as call schedule distribution, transition of patient care documents, etc.</li> </ul>  |
| Assessment Models or Tools  | <ul style="list-style-type: none"> <li>● Case Logs</li> <li>● Clinical and educational work hours logs</li> <li>● Conference attendance logs</li> <li>● Evaluation compliance</li> <li>● Medical chart review</li> <li>● Multisource feedback</li> <li>● Program director's reports documenting compliance with administrative requirements</li> </ul> |
| Curriculum Mapping  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| Notes or Resources  | <ul style="list-style-type: none"> <li>● ACGME Program Requirements for Graduate Medical Education in Thoracic Surgery</li> <li>● Institutional guidelines</li> </ul>  |

| <b>Professionalism 4: Well-Being</b>   |  |
|--|--|
| <b>Overall Intent:</b> To identify, use, manage, improve, and seek help for personal and professional well-being for self and others   |  |
| <b>Milestones</b>  | <b>Examples</b>  |
| <b>Level 1</b> <i>With assistance, recognizes status of personal and professional well-being</i>                                       | <ul style="list-style-type: none"> <li>• Acknowledges own response to patient’s death</li> </ul>   |
| <b>Level 2</b> <i>Independently recognizes status of personal and professional well-being</i>  | <ul style="list-style-type: none"> <li>• Independently identifies and communicates impact of a personal family tragedy</li> <li>• Identifies the impact of lack of sleep on performance</li> <li>• States symptoms of burnout</li> </ul>   |
| <b>Level 3</b> <i>Proposes a plan to optimize personal and professional well-being</i>   | <ul style="list-style-type: none"> <li>• With the multidisciplinary team, develops a reflective response to deal with personal impact of difficult patient encounters and disclosures</li> <li>• Does self-reflection to identify symptoms of burnout</li> </ul>   |
| <b>Level 4</b> <i>Executes a plan to optimize personal and professional well-being</i>   | <ul style="list-style-type: none"> <li>• Independently identifies ways to manage personal stress</li> <li>• Engages in activities to build resilience and well-being</li> </ul>  |
| <b>Level 5</b> <i>Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations</i> | <ul style="list-style-type: none"> <li>• Assists in organizational efforts to address clinician well-being after patient diagnosis/prognosis/death</li> </ul>  |
| Assessment Models or Tools   | <ul style="list-style-type: none"> <li>• Direct observation</li> <li>• Group interview or discussions for team activities</li> <li>• Individual interview</li> <li>• Institutional online training modules</li> <li>• Self-assessment and personal learning plan</li> </ul>  |
| Curriculum Mapping   | <ul style="list-style-type: none"> <li>•</li> </ul>  |
| Notes or Resources   | <ul style="list-style-type: none"> <li>• 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.</li> <li>• Local resources, including Employee Assistance</li> <li>• ACGME. “Well-Being Tools and Resources.” <a href="https://dl.acgme.org/pages/well-being-tools-resources">https://dl.acgme.org/pages/well-being-tools-resources</a>.2020.</li> </ul> |

| <b>Interpersonal and Communication Skills 1: Patient and Family-Centered Communication</b>   |  |
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| <b>Overall Intent:</b> To deliberately use language and behaviors to form a therapeutic relationship with patients and their families; to 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   |
| <p><b>Level 1</b> <i>Introduces themselves and explains their role to the patient and family</i></p> <p><i>Provides timely updates to patients and families</i></p> <p><i>Identifies common barriers to effective communication</i></p>  | <ul style="list-style-type: none"> <li>● Self-monitors and controls tone, non-verbal responses, and language and asks questions to invite the patient’s participation</li> <li>● Accurately communicates their role in the health care system to patients and families, and identifies loss of hearing, language, aphasia as common communication barriers in patient and family encounters</li> <li>● Communicates with patients and patients’ families on changing conditions</li> <li>● Provides patients with routine information, such as chest x-ray obtained earlier in the day is normal or that the hematocrit is stable</li> <li>● Identifies need for trained interpreter with non-English-speaking patients</li> </ul>   |
| <p><b>Level 2</b> <i>Delivers routine information to patients and families and confirms understanding</i></p> <p><i>Actively listens to patients and families to elicit patient preferences and expectations</i></p> <p><i>Identifies complex barriers to effective communication</i></p>  | <ul style="list-style-type: none"> <li>● Shares information and verifies patient understanding</li> <li>● Leads a discussion about acute pain management with the patient and the family, reassessing the patient’s and family’s understanding and anxiety</li> <li>● Identifies culture, religious beliefs, health literacy as complex communication barriers in patient and family encounters</li> </ul>   |
| <p><b>Level 3</b> <i>Delivers complex and difficult information to patients and families and confirms understanding</i></p> <p><i>Uses shared decision making to make a personalized care plan</i></p> <p><i>When prompted, reflects on personal biases while attempting to minimize communication barriers</i></p>                          | <ul style="list-style-type: none"> <li>● Establishes and maintains a therapeutic relationship with angry, non-compliant, substance seeking, and mentally challenged patients</li> <li>● Attempts to mitigate preconceived ideas about patients of certain race or weight through reflection on implicit biases, when prompted</li> <li>● When speaking to a patient, acknowledges uncertainty in a patient’s medical complexity and prognosis</li> <li>● 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</li> <li>● In a discussion with the faculty member, acknowledges discomfort in caring for a patient with lung cancer who continues to smoke</li> </ul> |

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| <p><b>Level 4</b> <i>Facilitates interdisciplinary patient and family conferences</i></p> <p><i>Effectively negotiates and manages conflict among patients, families, and the health care team</i></p> <p><i>Manages communication barriers and biases</i></p> | <ul style="list-style-type: none"> <li>● Facilitates family conference when family members disagree about the goals of care</li> <li>● Negotiates care management plan when interventions will be medically ineffective</li> <li>● Reflects on personal bias related to lung cancer death of resident’s father and solicits input from faculty about mitigation of communication barriers when counseling patients around smoking cessation</li> </ul>   |
| <p><b>Level 5</b> <i>Coaches others in the facilitation of difficult conversations</i></p> <p><i>Coaches others in conflict resolution</i></p>   | <ul style="list-style-type: none"> <li>● Mentors/coaches and supports colleagues in self-awareness and reflection to improve therapeutic relationships with patients</li> <li>● Creates a curriculum to teach conflict resolution in family conferences</li> </ul>   |
| <p>Assessment Models or Tools</p>  | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Kalamazoo Essential Elements Communication Checklist (Adapted)</li> <li>● Mini-clinical evaluation exercise</li> <li>● Multisource feedback</li> <li>● Self-assessment including self-reflection exercises</li> <li>● Standardized patients or structured case discussions</li> </ul>   |
| <p>Curriculum Mapping</p>  | <ul style="list-style-type: none"> <li>●</li> </ul>  |
| <p>Notes or Resources</p>  | <ul style="list-style-type: none"> <li>● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. <i>Med Teach</i>. 2011;33(1):6-8. <a href="https://www.tandfonline.com/doi/abs/10.3109/0142159X.2011.531170?journalCode=imte20">https://www.tandfonline.com/doi/abs/10.3109/0142159X.2011.531170?journalCode=imte20</a>. 2020.</li> <li>● Makoul G. Essential elements of communication in medical encounters: the Kalamazoo consensus statement. <i>Acad Med</i>. 2001;76:390-393. <a href="https://insights.ovid.com/crossref?an=00001888-200104000-00021">https://insights.ovid.com/crossref?an=00001888-200104000-00021</a>. 2020.</li> <li>● Makoul G. The SEGUE Framework for teaching and assessing communication skills. <i>Patient Educ Couns</i>. 2001;45(1):23-34. <a href="https://www.sciencedirect.com/science/article/abs/pii/S0738399101001367?via%3Dihub">https://www.sciencedirect.com/science/article/abs/pii/S0738399101001367?via%3Dihub</a>. 2020.</li> <li>● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in fellows. <i>BMC Med Educ</i>. 2009;9:1. <a href="https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2631014/">https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2631014/</a>. 2020.</li> </ul> |

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| <b>Interpersonal and Communication Skills 2: Interprofessional and Team Communication</b><br><b>Overall Intent:</b> To effectively communicate with the health care team, including consultants, in both straightforward and complex situations                 |   |
|---|---|
| Milestones  | Examples  |
| <p><b>Level 1</b> <i>Respectfully requests a consultation</i></p> <p><i>Respectfully receives a consultation request</i></p> <p><i>Uses language that values all members of the health care team</i></p>  | <ul style="list-style-type: none"> <li>● Politely ask for a cardiology consultation for a patient with post-operative myocardial infarction</li> <li>● Receives consult request for a patient with metastatic lung cancer, asks clarifying questions politely, and expresses gratitude for the consult</li> <li>● Acknowledges the contribution of each member of the surgical team to the patient</li> </ul>   |
| <p><b>Level 2</b> <i>Clearly and concisely requests a consultation</i></p> <p><i>Clearly and concisely responds to a consultation request</i></p> <p><i>Communicates information effectively with all health care team members</i></p>                          | <ul style="list-style-type: none"> <li>● When asking for a cardiology consultation for a patient with post-operative myocardial infarction, respectfully relays the clinical course and need for angiography</li> <li>● Responds in a timely manner to primary team regarding lack of surgical options for a patient with metastatic lung cancer</li> <li>● Sends a message in EHR to the dietician of an esophagectomy patient to increase the protein intake</li> </ul> |
| <p><b>Level 3</b> <i>Verifies own understanding of consultant recommendations</i></p> <p><i>Verifies understanding of recommendations when providing consultation</i></p> <p><i>Uses active listening to adapt communication style to fit team needs</i></p>    | <ul style="list-style-type: none"> <li>● When receiving treatment recommendations from an attending physician, repeats back the plan to ensure understanding</li> <li>● After a consultation from infectious disease has been completed, confirms understanding of the antibiotic course and who will place the order</li> <li>● Summarizes a consultant recommendation in the progress notes</li> </ul>  |
| <p><b>Level 4</b> <i>Coordinates recommendations from different members of the health care team to optimize patient care</i></p> <p><i>Navigates and resolves disagreements with interprofessional team</i></p> <p><i>Mediates conflict within the team</i></p> | <ul style="list-style-type: none"> <li>● Initiates a multidisciplinary meeting to developed shared care plan for a patient with multi-organ system failure</li> <li>● Explains surgical rationale for contraindications of ECMO in a heart failure patient with the critical care and cardiology physicians</li> <li>● Speaks directly to a consultant to avoid miscommunication in the medical record</li> </ul>   |

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| <p><b>Level 5 Models flexible communication strategies that value input from all health care team members, resolving conflict when needed</b></p> | <ul style="list-style-type: none"> <li>● Creates a curriculum for team communication and resolving conflict</li> <li>● Participates in a course on difficult conversations</li> </ul>   |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Global assessment</li> <li>● Medical record (chart) audit</li> <li>● Multisource feedback</li> <li>● Simulation</li> </ul>   |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. <i>Med Teach</i>. 2019;41(7):1-4. <a href="https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499">https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499</a>. 2020.</li> <li>● Green M, Parrott T, Cook G., Improving your communication skills. <i>BMJ</i>. 2012;344:e357. <a href="https://www.bmj.com/content/344/bmj.e357">https://www.bmj.com/content/344/bmj.e357</a>. 2020.</li> <li>● Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. <i>Med Teach</i>. 2013;35(5):395-403. <a href="https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677">https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677</a>. 2020.</li> <li>● Dehon E, Simpson K, Fowler D, Jones A. Development of the faculty 360. <i>MedEdPORTAL</i>. 2015;11:10174. <a href="https://www.mededportal.org/publication/10174/">https://www.mededportal.org/publication/10174/</a>. 2020.</li> <li>● Lane JL, Gottlieb RP. Structured clinical observations: a method to teach clinical skills with limited time and financial resources. <i>Pediatrics</i>. 2000;105(4):973-977. <a href="https://pdfs.semanticscholar.org/8a78/600986dc5cffcab89146df67fe81aebeaecc.pdf">https://pdfs.semanticscholar.org/8a78/600986dc5cffcab89146df67fe81aebeaecc.pdf</a>. 2020.</li> <li>● Braddock CH, Edwards KA, Hasenberg NM, Laidley TL, Levinson W. Informed decision making in outpatient practice: time to get back to basics. <i>JAMA</i>. 1999;282(24):2313-2320. <a href="https://jamanetwork.com/journals/jama/fullarticle/192233">https://jamanetwork.com/journals/jama/fullarticle/192233</a>. 2020.</li> </ul> |

| <b>Interpersonal and Communication Skills 3: Communication within Health Care Systems</b><br><b>Overall Intent:</b> To effectively communicate using a variety of methods  |  |
|--|--|
| Milestones   | Examples   |
| <p><b>Level 1</b> <i>Accurately and timely documents information in the patient record</i></p> <p><i>Safeguards patient personal health information</i></p> <p><i>Communicates through appropriate channels as required by institutional policy</i></p>  | <ul style="list-style-type: none"> <li>● Documentation is accurate but may include extraneous information</li> <li>● Shreds patient list after rounds; avoids talking about patients in the elevator</li> <li>● Identifies institutional and departmental communication hierarchy for concerns and safety issues</li> </ul>  |
| <p><b>Level 2</b> <i>Completes documentation thoroughly and communicates diagnostic and therapeutic reasoning in an organized fashion</i></p> <p><i>Documents required data in formats specified by institutional policy</i></p> <p><i>Respectfully communicates concerns about the system</i></p>   | <ul style="list-style-type: none"> <li>● Organized and accurate documentation outlines clinical reasoning that supports the treatment plan</li> <li>● Uses documentation templates</li> <li>● Recognizes that a communication breakdown has happened and respectfully brings the breakdown to the attention of the chief resident or faculty member</li> </ul>                       |
| <p><b>Level 3</b> <i>Completes documentation accurately, concisely, and completely</i></p> <p><i>Appropriately selects direct and indirect forms of communication</i></p> <p><i>Uses appropriate channels to offer clear and constructive suggestions to improve the system</i></p>  | <ul style="list-style-type: none"> <li>● Complex clinical thinking is documented concisely but may not contain anticipatory guidance</li> <li>● Calls patient immediately about potentially critical test result</li> <li>● Uses institutional reporting system after a medication error</li> </ul>  |
| <p><b>Level 4</b> <i>Communicates in a clearly organized, concise, and timely manner, and includes anticipatory guidance</i></p> <p><i>Uses written and verbal communication (e.g., patient notes, email) in a professional manner</i></p> <p><i>Initiates difficult conversations with appropriate stakeholders to improve the system</i></p> | <ul style="list-style-type: none"> <li>● Creates documentation that is consistently accurate, organized, and concise, and frequently incorporates anticipatory guidance</li> <li>● Notes are exemplary and used to teach others</li> <li>● Respectfully closes the loop with an emergency room physician about breakdowns in communication in order to prevent recurrence</li> </ul> |

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|---|---|
| <p><b>Level 5 Models feedback to improve others' written communication</b></p> <p><i>Guides departmental or institutional communication around policies and procedures</i></p> <p><i>Facilitates dialogue regarding systems issues among larger community stakeholders (institution, health care system, field)</i></p> | <ul style="list-style-type: none"> <li>● Leads a task force established by the hospital QI committee to develop a plan to improve house staff hand-offs</li> <li>● Meaningfully participates in a committee following a patient safety event in the ICU such as inadvertent removal of ECMO cannula</li> <li>● Participates on a task force generated by a root cause analysis</li> </ul>   |
| <p>Assessment Models or Tools</p>   | <ul style="list-style-type: none"> <li>● Direct observation</li> <li>● Medical record (chart) audit</li> <li>● Multisource feedback</li> </ul>  |
| <p>Curriculum Mapping</p>   | <ul style="list-style-type: none"> <li>●</li> </ul>   |
| <p>Notes or Resources</p>   | <ul style="list-style-type: none"> <li>● 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. <i>Teach Learn Med.</i> 2017;29(4):420-432. <a href="https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385">https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385</a>. 2020.</li> <li>● Haig KM, Sutton S, Whittington J. SBAR: a shares mental model for improving communications between clinicians. <i>Jt Comm J Qual Patient Saf.</i> 2006;32(3):167-75. <a href="https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext">https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext</a>. 2020.</li> </ul> |

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In an effort to aid programs in the transition to using the new version of the Milestones, the original Milestones 1.0 have been mapped to the new Milestones 2.0. Also indicated below are where the subcompetencies are similar between versions. These are not necessarily exact matches but are areas that include some of the same elements. Note that 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: Ischemic Heart Disease   | PC1: Ischemic Heart Disease   |
| PC2: Cardiopulmonary Bypass, Myocardial Protection and Temporary Circulatory Support  | PC2: Mechanical Circulatory Support   |
| PC3: Valvular Disease   | PC3: Valvular Disease   |
| PC4: Great Vessel Disease   | PC4: Great Vessel Disease   |
| PC5: Esophagus  | PC5: Esophagus  |
| PC6: Lung and Airway  | PC6: Lung and Airway  |
| PC7: Chest Wall/Pleura/Mediastinum/Diaphragm  | PC7: Chest Wall/Pleura/Mediastinum/Diaphragm  |
| PC8: Critical Care  | PC8: Critical Care  |
| No match  | PC9: Technical Skills for General Surgery (Integrated only)   |
| MK1: Ischemic Heart Disease   | MK1: Cardiovascular Surgical Knowledge  |
| MK2: Cardiopulmonary Bypass, Myocardial Protection and Temporary Circulatory Support  |   |
| MK3: Valvular Disease   |   |
| MK4: Great Vessel Disease   |   |
| MK5: Congenital Heart Disease   |   |
| MK6: End Stage Cardiopulmonary Disease  | MK3: Congenital Heart Disease   |
| MK7: Esophagus  | No match  |
| MK8: Lung and Airway  | MK2: General Thoracic Surgical Knowledge  |
| MK9: Chest Wall/Pleura/Mediastinum/Diaphragm  |   |
| MK10: Critical Care   |   |
| SBP1: Patient Safety  | SBP1: Patient Safety and Quality Improvement  |
| SBP2: Resource Allocation   | SBP3: Physician Role in Health Care Systems   |
| SBP3: Practice Management   | SBP3: Physician Role in Health Care Systems   |
| PBL11: the ability to investigate and evaluate the care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation, evidence based guidelines and life-long learning | PBL11: Evidence-Based and Informed Practice<br>PBL12: Reflective Practice and Commitment to Personal Growth |
| PBL12: Research and Teaching  | PBL11: Evidence-Based and Informed Practice   |

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|  |  |
|--|--|
| PROF1: Ethics and Values                     | PROF1: Professional Behavior and Ethical Principles  |
| PROF2: Personal Accountability               | PROF2: Accountability/ Conscientiousness   |
| No match                                     | PROF3: Self-Awareness and Well-Being   |
| ICS1: Interpersonal and Communication Skills | ICS1: Patient and Family-Centered Communication<br>ICS2: Interprofessional and Team Communication<br>SBP2: System Navigation for Patient-Centered Care |
| No match                                     | 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/>