

The Milestones Project

Walter H. Merrill, M.D.

Accreditation Council
for Graduate Medical Education
Next Accreditation System

NEJM 2012; 366-11:1051-1056

Background Information

- 1999 ACGME introduces six clinical competencies
- 2009 Restructuring of accreditation system based on educational outcomes
- 2013 Phased implementation of NAS
- 2014 NAS adopted in cardiothoracic surgery

Aims of NAS

- Enhance ability of training programs to prepare physicians for practice
- Allow ACGME to accredit training programs based on educational outcomes
- Reduce the burden associated with current structure and process-based approach

Stakeholders Expect

- Physicians be leaders of team-oriented care
- Literacy in information technology to improve care
- Sensitivity to cost-effectiveness
- Involve patients in their own care
- Physicians possess skills and requisite clinical and professional attributes

Limitations of Current Accreditation

- Program requirements prescriptive
- Diminished opportunities for innovation
- Increased administrative burdens
- Care delivery-system changes outpace educational standards
- Emphasis on process, less so on outcomes

Next Accreditation System

- July 2013: emergency medicine, internal medicine, neurologic surgery, orthopedic surgery, pediatrics, diagnostic radiology, urology
- July 2014: full implementation
- Move to annual data collection
- RRC performs annual trend evaluation: Milestones, resident and faculty survey data, operative case log data, educational outcomes
- Clinical Competency Committee

Next Accreditation System

- Elimination of PIF
- 10 year cycle of self-study
- 10 year cycle of accreditation site visit
- Submit Milestones data semiannually

Educational Milestones

- Measurement tools to assess educational outcomes
- Close collaboration of RRC, ABTS, TSDA, JCTSE and professional societies
- Assess the attainment of competency in a logical trajectory of professional development
- Composite Milestones data submitted semiannually, representing consensus of Clinical Competency Committee

Educational Milestones

- Organized under six competency domains
- Observable steps on continuum of increasing ability
- Describe trajectory from neophyte to practitioner
- Intuitively known by experienced educators
- Provide framework and language to describe progress
- Articulate shared understanding of expectations
- Set aspirational goals of excellence

ACGME Goals for Milestones

- Permits fruition of the promise of focus on outcomes
- Tracks what is important
- Uses universal tools for assessments
- RRCs track unidentified individuals' trajectories
- Specialty specific normative data

Educational Milestones

Working group

Edward Bove	Carolyn Reed (Chair)
Andrea Carpenter	Peggy Simpson
Laura Edgar	Ara Vaporciyan
Jim Fann	Thomas Varghese
Robert Higgins	Edward Verrier
Richard Lee	Cameron Wright
Walter Merrill	Stephen Yang
Tom Nguyen	

Educational Milestones

Advisory Group

William Baumgartner

David Fullerton

Timothy Brigham

John Potts

John Calhoon

Doug Wood

Medical Knowledge: Cardiopulmonary Bypass, Myocardial Protection and Temporary Circulatory Support

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Lists basic components of cardiopulmonary bypass apparatus (e.g., oxygenator, pump heads, heat exchanger, low level alarm, in line monitoring) • Understands pulsatile vs. non-pulsatile pump physiology • Understands basic myocardial protection. (e.g., O2 requirement, O2 delivery, myocardial relaxation) • Understands coagulation cascade (e.g., intrinsic and extrinsic pathways) • Lists complications of cardiopulmonary bypass (e.g., bleeding, renal failure, pulmonary dysfunction) 	<ul style="list-style-type: none"> • Discusses options for myocardial protection (e.g., cardioplegia vs. beating heart) • Discusses cannulation techniques and options for cardiopulmonary bypass (e.g., single venous, bicaval, aortic, peripheral arteries, cold, full or partial) • Understands intra-aortic balloon pump physiology (e.g., diastolic augmentation and presystolic dip) • Understands coagulation cascade inhibitors (e.g., heparin, argatroban) • Understands complications of cardiopulmonary bypass • Lists treatment strategies for cardiac injury without cardiac bypass, including trauma 	<ul style="list-style-type: none"> • Demonstrates knowledge of cardioplegia solutions and delivery modes (e.g., crystalloid, blood, antegrade, retrograde) • Demonstrates knowledge of acid-base and anticoagulation management on cardiopulmonary bypass (e.g., pH stat, alpha stat, ACT) • Demonstrates knowledge of pharmacologic management of postcardiotomy hemodynamics (e.g., inotropes, vasodilators) • Discusses advantages and disadvantages of different myocardial protection strategies • Lists management strategies of routine complications related to cardiopulmonary bypass (e.g., air in the heart, inadequate drainage, incomplete arrest) • Demonstrates knowledge of postoperative sequelae from cardiopulmonary bypass (e.g., low cardiac output syndrome, coagulopathies, arrhythmias, HIT) 	<ul style="list-style-type: none"> • Explains advanced cardiopulmonary support (e.g., circulatory arrest or ECMO) • Explains the management of postcardiotomy shock syndrome (e.g., inotropes, IABP, mechanical support) • Explains management strategies of complex complications related to cardiopulmonary bypass (e.g., aortic dissection, air embolism) • Explains treatment strategies for postoperative sequelae from cardiopulmonary bypass (e.g., low cardiac output syndrome, coagulopathies, arrhythmias, HIT) 	<ul style="list-style-type: none"> • Develops simulation scenarios for complications related to cardiopulmonary bypass

Comments:

Patient Care and Technical Skills: Cardiopulmonary Bypass, Myocardial Protection and Temporary Circulatory Support

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Demonstrates basic surgical skills (simulation vs. OR) 	<ul style="list-style-type: none"> • Performs axillary, femoral, arterial or venous cannulation • Performs peripheral vascular access • Performs surgical opening and closing • Assists perfusionist with cardiopulmonary bypass setup and pump run 	<ul style="list-style-type: none"> • Cannulates and institutes cardiopulmonary bypass including myocardial protection in routine cases • Manages cardiopulmonary bypass and myocardial protection in routine cases • Weans and decannulates from cardiopulmonary bypass for routine cases • Recognizes and manage common acute complications (e.g., coagulopathy, pump failure) 	<ul style="list-style-type: none"> • Cannulates and institutes cardiopulmonary bypass including myocardial protection in complex cases • Manages cardiopulmonary bypass and myocardial protection in complex cases • Weans and decannulates from cardiopulmonary bypass for complex cases • Institutes temporary circulatory support for cardiogenic shock (e.g., intraaortic balloon pump, ECMO, short term LV assist) • Recognizes and manages unusual acute complications (e.g., aortic dissection) 	<ul style="list-style-type: none"> • Operates in a hostile chest (e.g., radiation, porcelain aorta, use of epiaortic probe, patent grafts) • Performs left ventricular assist device procedures or transplant

Comments:

Medical Knowledge: Valvular Disease

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Knows basic anatomy and pathology of valvular heart disease • Knows basic normal valve physiology • Lists clinical manifestations of isolated valvular heart disease (e.g., dyspnea, angina, edema, syncope) • Lists diagnostic tools available for evaluation of valvular heart disease • Lists treatment options for valvular heart disease • Knows basic complications for valvular heart disease (e.g., peri-operative complications for aortic valve replacement) 	<ul style="list-style-type: none"> • Knows common variations in anatomy and pathology of valvular heart disease (e.g., Mitral Prolapse, Type 1,2 and 3) • Explains physiologic changes accompanying valvular heart disease (e.g., pulmonary hypertension) • Generates differential diagnosis of diseases with similar manifestations (e.g., coronary artery disease, emphysema) • Explains advantages and disadvantages of diagnostic tools in evaluating valvular heart disease (e.g., surface vs. transesophageal echo) • Recites advantages and disadvantages of various treatment options for valvular heart disease (e.g., repair vs. replacement) • Recites risks, benefits and complications of treatment modalities (e.g., cites frequency of common complications) 	<ul style="list-style-type: none"> • Explains complex integrations between anatomy and pathology of valvular heart disease (e.g., bicuspid aortic valve and stenosis, functional mitral and tricuspid regurgitation) • Explains the role of treatment on physiology of valvular heart disease, including arrhythmia management, (e.g., the mechanism of surgical atrial fibrillation treatment) • Identifies the common variants of the clinical manifestations of valvular heart disease (e.g., fatigue, exercise intolerance) • Interprets normal and common abnormalities associated with valvular heart disease, including intraoperative transesophageal echocardiography • Identifies appropriate treatment for routine patient with valvular heart disease • Familiar with ACC/STS/AATS guidelines • Explains basic outcome literature for valvular heart disease (e.g., durability of mitral valve repair) 	<ul style="list-style-type: none"> • Explains complex variations in anatomy and pathology, including congenital (e.g., contribution of coronary disease to mitral regurgitation, bicuspid aortic valve and ascending aneurysm) • Adapts therapeutic management based on understanding of physiology (e.g., explains when to correct mitral or tricuspid regurgitation in setting of aortic stenosis or coronary artery disease) • Distinguishes the complex clinical manifestations and complications of valvular heart disease (e.g., staging of congestive heart failure) • Interprets and integrates complex abnormalities associated with valvular heart disease (e.g., hypertrophic obstructive cardiomyopathy) • Identifies appropriate treatment for complex patient with valvular heart disease (e.g., combined coronary, aneurysm or root enlargement) • Explains outcomes for all treatment modalities and complications, including databases and clinical trials (e.g., outcome after minimally invasive valves, success of sinus restoration in surgery for atrial fibrillation) 	<ul style="list-style-type: none"> • Presents on outcomes valvular heart disease at local, regional or national meeting

Comments:

Patient Care and Technical Skills: Valvular Disease

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Orders basic diagnostic and preoperative assessment tests for valvular heart disease • Lists basic treatment options for routine valvular heart disease • Demonstrates basic surgical skills (simulation vs. OR) 	<ul style="list-style-type: none"> • Interprets and prioritizes diagnostic and physiologic assessment tests for routine patient with valvular heart disease (e.g., echocardiogram, cardiac cath) • Suggests treatment plan for patient with routine single valvular heart disease (e.g., single valve replacement in a symptomatic patient with aortic stenosis) • Recognizes routine post-operative complications (e.g., identifies surgically significant bleeding) • Identifies surgical approach for each valve • Performs surgical opening and closing • Performs basic intraoperative assisting 	<ul style="list-style-type: none"> • Provides a diagnostic and assessment plan for patients with routine valvular heart disease (e.g., intra-operative transesophageal echocardiogram) • Selects ideal treatment option for patient with acquired valvular heart disease (e.g., double valve replacement) • Manages routine post-operative complications (e.g., decides to return to operating room, management of heart block) • Institutes and weans patient from cardiopulmonary bypass • Performs optimal myocardial protection strategy • Performs routine valvular replacement 	<ul style="list-style-type: none"> • Forms a diagnostic and assessment plan for complex patients with valvular heart disease (e.g., intra-operative mitral regurgitation on a patient scheduled for isolated coronary artery bypass) • Selects ideal treatment option for patient with complex valvular heart disease (e.g., valvular repair, congenital valve repair) • Manages complex post-operative complications, including arrhythmias (e.g., management of paravalvular leak or SAM) • Performs complex valvular replacement • Performs valvular repair 	<ul style="list-style-type: none"> • Selects ideal plan for a patient with prior transcatheter valve, minimally invasive valve • Performs minimally invasive, percutaneous, or robotic approaches to valvular heart disease • Performs atrial and ventricular arrhythmia surgery • Performs reconstruction of fibrous trigone in patient with endocarditis of mitral and aortic valves

Comments:

Medical Knowledge: Esophagus

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Knows basic anatomy and pathology (e.g., identifies gastrointestinal anatomy innervation and blood supply, endoscopic landmarks) • Knows basic foregut physiology (e.g., basic esophageal motility) • Lists clinical manifestations of benign and malignant disorders (e.g., heart burn, chest pain, dysphagia, odynophagia) • Lists diagnostic and/or staging tools available for the evaluation of benign and malignant disorders (e.g., manometry, pH testing, EUS) • Lists treatment options for benign and malignant disorders (e.g., surgery vs. chemo/RT vs. chemo/RT alone for malignancy) • Knows basic complications for benign and malignant disorders (e.g., perforation, recurrent reflux, pulmonary aspiration) 	<ul style="list-style-type: none"> • Understands common variations in anatomy and pathology (e.g., lymphatic drainage) • Understands physiologic changes accompanying malignancy and motility disorders (e.g., achalasia, reflux, esophageal spasm) • Generates differential diagnosis of disease with similar manifestations (e.g., achalasia vs. pseudoachalasia; coronary syndrome vs. esophageal spasm) • Understands advantages and disadvantages of diagnostic tools in evaluating benign and malignant disorders (e.g., endoscopy vs. EUS vs. barium swallow) • Understands advantages and disadvantages of various treatment options for benign and malignant disorders, including the impact of staging (e.g., plus and minus of treatment options for esophageal cancer - dilation vs. myotomy for achalasia) • Understands risks, benefits and complications of treatment modalities (e.g., slipped Nissen, anastomotic leak) 	<ul style="list-style-type: none"> • Understands complex integrations between anatomy and pathology (e.g., fascial planes in descending mediastinitis) • Understands the role of treatment on physiology of malignancy and motility disorders (e.g., post-op esophagectomy complications - dumping syndrome) • Identifies the common variants of the clinical manifestations of benign and malignant disorders (e.g., benign vs. malignant stricture) • Interprets normal and common abnormalities associated with benign and malignant disorders (e.g., interprets EUS, common motility tracings) • Identifies appropriate treatment for routine patient with benign and malignant disorders (e.g., treatment options for high grade dysplasia - EMR vs. esophagectomy) • Knows basic outcome literature for benign and malignant disorders 	<ul style="list-style-type: none"> • Understands complex variations in anatomy and pathology, including congenital (e.g., esophageal atresia) • Adapts therapeutic management based on understanding of physiology for various disease states (e.g., partial vs. total fundoplication) • Distinguishes the complex clinical manifestations and complications of benign and malignant disorders (e.g., Type IV hernias, TEF) • Interprets and integrates complex abnormalities associated with benign and malignant disorders (e.g., short esophagus, achalasia with sigmoid esophagus) • Identifies appropriate treatment for complex patient with benign and malignant disorders, (e.g., primary vs. redo Nissen, redo myotomy vs. esophagectomy) • Knows outcomes for all treatment modalities and complications, including databases and clinical trials 	<ul style="list-style-type: none"> • Understands imaging for colon interposition • Understands need for colon interposition • Presents on outcomes of benign or malignant disorders at local, regional or national meeting

Comments:

Patient Care and Technical Skills: Esophagus

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Performs preoperative assessment • Orders basic diagnostic/assessment tests for routine benign and malignant esophageal disease (e.g., EUS, CT/PET, pH testing, manometry) • Demonstrates basic surgical skills (simulation vs. OR) 	<ul style="list-style-type: none"> • Interprets hemodynamics and suggests appropriate diagnostic imaging • Recognizes routine post-operative complications • Prioritizes diagnostic/assessment tests for routine benign and malignant esophageal disease (e.g., Barium swallow vs. EUS vs. endoscopy) • Lists basic treatment options for routine benign and malignant esophageal disease (e.g., Nissen fundoplication, esophageal resection, Toupet) • Recognizes common post-operative complications (e.g., leak, slipped Nissen, cardiac arrhythmia) • Demonstrates basic endoscopic skills • Demonstrates basic minimally invasive skills (FLS) • Provides basic intraoperative assistance • Performs basic hand sewn and stapled anastomosis 	<ul style="list-style-type: none"> • Develops a treatment plan for routine patient with benign and malignant disorders • Manages routine post-operative complications • Interprets diagnostic/assessment tests for routine benign and malignant esophageal disease (e.g., basic manometry tracings, EUS and PET/CT scan results) • Selects ideal treatment option after assessment of diagnostic test results for routine benign and malignant esophageal disease. • Manages common post-operative complications (e.g., surgical vs. medical management, reintubation) • Demonstrates advanced endoscopic skills (EMR, EUS, stenting) • Performs routine open and minimally invasive motility operations 	<ul style="list-style-type: none"> • Develops a treatment plan for complex patient with benign and malignant disorders • Manages complex post-operative complications • Able to establish a diagnostic and assessment plan for complex patients with benign and malignant esophageal disease (e.g., short esophagus, sigmoid esophagus) • Selects ideal treatment option for complex benign and malignant esophageal disease (e.g., consideration of comorbidities, chemo/RT/surgery vs. surgery vs. chemo/RT, does patient have short esophagus) • Manages complex post-operative complications (e.g., fistula, gastric necrosis) • Performs routine esophageal resections • Operatively manages esophageal perforation/trauma 	<ul style="list-style-type: none"> • Performs complex esophageal resections (e.g., colon interposition) • Performs redo motility operations • Performs minimally invasive esophagectomy

Comments:

Patient Care and Technical Skills: Critical Care

Level1	Level2	Level3	Level4	Level5
<ul style="list-style-type: none"> • Orders basic diagnostic, nutritional and assessment tests for critically ill patients with cardiovascular and thoracic diseases (e.g., pre and post-operative) • Lists basic treatment options for critically ill patients with cardiovascular and thoracic diseases • Orders appropriate prophylactic ICU measures to prevent complications (e.g., nutritional support, glucose management, ulcer and DVT prophylaxis) • Obtains ACLS certification • Demonstrates basic ICU surgical skills (simulation or bedside), including IV, arterial line, Foley catheter, NG tube 	<ul style="list-style-type: none"> • Interprets and prioritizes diagnostic and physiologic assessment tests for critically ill patients with cardiovascular and thoracic diseases • Suggests treatment plan for critically ill patients with cardiovascular and thoracic diseases, including preventive care (e.g., prophylactic antibiotics) • Recognizes routine ICU related complications (e.g., line sepsis, DVT, ventilator acquired pneumonia, pneumothorax) • Performs cardioversion for arrhythmias • Demonstrates advanced ICU surgical skills (simulation or bedside), including central line, PA catheter, chest tube • Demonstrates routine ventilator management • Manages temporary pace maker 	<ul style="list-style-type: none"> • Establishes a diagnostic and assessment plan for critically ill patients with cardiovascular and thoracic diseases • Selects ideal treatment option for critically ill patients with cardiovascular and thoracic diseases • Manages routine ICU complications (e.g., line sepsis, DVT, ventilator acquired pneumonia, pneumothorax) • Demonstrates complex ventilator management • Performs open chest resuscitation • Performs emergency pericardiocentesis 	<ul style="list-style-type: none"> • Establishes a diagnostic and assessment plan for complex critically ill patients with cardiovascular and thoracic diseases (e.g., patient with multi-system organ failure) • Selects ideal treatment option for complex critically ill patients with cardiovascular and thoracic diseases • Manages complex ICU related complications (e.g., ARDS, acute renal failure, low cardiac output, stroke, metabolic abnormalities) • Troubleshoots assist devices 	<ul style="list-style-type: none"> • Obtains board certification in critical care.

Comments:

Interpersonal and Communication Skills

Level 1	Level 2	Level 3	Level 4	Level 5
<ul style="list-style-type: none"> • Develops a positive relationship with patients in uncomplicated situations and recognizes communication conflicts. • Recognizes multidisciplinary approach to patient care. • Understands the patient's/family's perspective while engaged in active listening. • Utilizes interpreters, as needed. • Appreciates effective communication to prevent medical error. • Participates in effective transitions of care. 	<ul style="list-style-type: none"> • Negotiates and manages simple patient/family-related, and team conflicts. • Responds to the social and cultural context of the patient and family to ensure the patient understands and ability to participate in health care decision-making. • Understands the effects of computer use on information accuracy and potential effects on the physician/patient relationship. 	<ul style="list-style-type: none"> • Sustains working relationships and manages complex and challenging situations, including transitions of care. • Customizes the delivery of emotionally difficult information. • Manages transitions of care and optimizes communication across systems. • Maintains collegial relationship with other professional staff. 	<ul style="list-style-type: none"> • Negotiates and manages conflict in complex and challenging situations (including vulnerable populations) and develops working relationships across specialties and systems of care. • Organizes and facilitates family/ healthcare team conferences • Able to facilitate/lead team based care activities, e.g., OR team, multidisciplinary cancer conference. • Uses multiple forms of communication (e.g., email, patient portal, social media) ethically and with respect for patient privacy. 	<ul style="list-style-type: none"> • Develops models/approaches to managing difficult communications and seeks leadership opportunities within professional organizations. • Coaches others to improve communication skills.

Comments:

Systems Based Practice – Patient Safety

Level1	Level2	Level3	Level4	Level5
<ul style="list-style-type: none"> • Understands the differences between medical errors, near misses, and sentinel events. • Understands the roles of care team members. 	<ul style="list-style-type: none"> • Participates in the use of tools to prevent adverse events (e.g., checklists and briefings). • Describes the common system causes for errors. 	<ul style="list-style-type: none"> • Consistently uses tools to prevent adverse events (e.g., checklists and briefings). • Reports problematic behaviors, processes, and devices including errors and near misses. • Demonstrates structured communication tool for hand-offs. 	<ul style="list-style-type: none"> • Participates in the analysis of shared team experiences to prevent future errors using proven analysis techniques (e.g., root cause analysis, failure mode effects analysis). • Leads team by promoting situational awareness and input by all team members. • Conducts morbidity and mortality conference to improve patient safety. 	<ul style="list-style-type: none"> • Leads curriculum design to teach teamwork and communication skills to healthcare professionals. • Leads multidisciplinary teams (e.g., human factors engineers, social scientists) to address patient safety issues.

Comments:

Summary

- Milestones for CT Surgery implemented July 2014
- Semiannual assessment of residents by Clinical Competency Committee using Milestones
- Goal is to help all residents achieve Level 4 by the time they complete training
- Level 5 achievement is desired goal to be achieved later in practice

Conclusions

- Next Accreditation System
 - Creates national framework for assessment (Milestones)
 - Reduction in administrative burden and eliminates focus on process
 - Stimulates innovation in education; raise the ceiling and the floor