Curriculum for neurogastroenterology and motility training

A report from the joint ANMS-ESNM task force

Gyawali, C P; Savarino, E; Lazarescu, A; Bor, S; Patel, A; Dickman, R; Pressman, A; Drewes, A M; Rosen, J; Drug, V; Saps, M; Novais, L; Vazquez-Roque, M; Pohl, D; van Tilburg, M A L; Smout, A; Yoon, S; Pandolfino, J; Farrugia, G; Barbara, G; Roman, S

Published in:
Neurogastroenterology and Motility

DOI (link to publication from Publisher):
10.1111/nmo.13341

Publication date:
2018

Document Version
Publisher's PDF, also known as Version of record

Received: 14 January 2018 | Accepted: 18 February 2018

DOI: 10.1111/nmo.13341

POSITION PAPER

WILEY Neurogastroenterology & Motility NGM

Curriculum for neurogastroenterology and motility training: A report from the joint ANMS-ESNM task force

C. P. Gyawali[1] | E. Savarino[2] | A. Lazarescu[3] | S. Bor[4] | A. Patel[5] | R. Dickman[6] | A. Pressman[7] | A. M. Drewes[8] | J. Rosen[9] | V. Drug[10] | M. Saps[11] | L. Novais[12] | M. Vazquez-Roque[13] | D. Pohl[14] | M. A. L. van Tilburg[15,16,17] | A. Smout[18] | S. Yoon[19] | J. Pandolfino[20] | G. Farrugia[13] | G. Barbara[21] | S. Roman[22,23]

[1]Division of Gastroenterology, Washington University School of Medicine, St. Louis, MO, USA

[2]Division of Gastroenterology, Department of Surgical, Oncological and Gastroenterological Sciences, University of Padua, Padua, Italy

[3]Division of Gastroenterology, University of Alberta, Edmonton, Canada

[4]Department of Gastrenterology, Ege University, Izmir, Turkey

[5]Duke University School of Medicine and the Durham VA Medical Center, Durham, NC, USA

[6]Division of Gastroenterology, Rabin Medical Center and The Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel

[7]Division of Gastroenterology, Brown University, Providence, RI, USA

[8]Mech-Sense, Department of Gastroenterology & Hepatology, Aalborg University Hospital, Aalborg, Denmark

[9]Division of Pediatric Gastroenterology, Hepatology, and Nutrition, Children's Mercy Hospital, Kansas City, USA

[10]Institute of Gastroenterology and Hepatology, University Hospital "St Spiridon", University of Medicine and Pharmacy "Gr T Popa", Iasi, Romania

[11]Division of Pediatric Gastroenterology, Hepatology and Nutrition, University of Miami, Miami, FL, USA

[12]Neurogastroenterology and Gastrointestinal Motility Lab, New University of Lisbon, Lisbon, Portugal

[13]Division of Gastroenterology and Hepatology, Mayo Clinic, Jacksonville, FL, USA

[14]Klinik fur Gastroenterologie und Hepatologie, University of Zurich, Zurich, Switzerland

[15]College of Pharmacy & Health Sciences, Campbell University, Buies Creek, NC, USA

[16]Department of Medicine, University of North Carolina, Chapel Hill, NC, USA

[17]School of Social Work, University of Washington, Seattle, WA, USA

[18]Department of Gastroenterology and Hepatology, Academic Medical Center, Amsterdam, The Netherlands

[19]Division of Gastroenterology and Hepatology, University of Rochester, Rochester, NY, USA

[20]Division of Gastroenterology, Department of Medicine, Northwestern University, Chicago, IL, USA

[21]Department of Medical and Surgical Sciences, University of Bologna, Bologna, Italy

[22]Digestive Physiology, Université de Lyon, Hospices Civils de Lyon, Lyon, France

[23]Digestive Physiology, Université de Lyon, Lyon I University, Lyon, France

Correspondence
C. Prakash Gyawali, Division of Gastroenterology, St. Louis, MO, USA.
Email: cprakash@wustl.edu.

Fully endorsed by the American Neurogastroenterology and Motility Society (ANMS), European Society of Neurogastroenterology and Motility (ESNM), Australasian Neurogastroenterology and Motility Association (ANGMA), Asian Neurogastroenterology and

Abstract

Although neurogastroenterology and motility (NGM) disorders are some of the most frequent disorders encountered by practicing gastroenterologists, a structured competency-based training curriculum developed by NGM experts is lacking. The American Neurogastroenterology and Motility Society (ANMS) and the European Society of Neurogastroenterology and Motility (ESNM) jointly evaluated the components of NGM training in North America and Europe. Eleven training domains were

Motility Association (ANMA), Sociedad Latinoamericana de Neurogastroenterologia (SLNG) and American Society for Gastrointestinal Endoscopy (ASGE)

identified within NGM, consisting of functional gastrointestinal disorders, visceral hypersensitivity and pain pathways, motor disorders within anatomic areas (esophagus, stomach, small bowel and colon, anorectum), mucosal disorders (gastroesophageal reflux disease, other mucosal disorders), consequences of systemic disease, consequences of therapy (surgery, endoscopic intervention, medications, other therapy), and transition of pediatric patients into adult practice. A 3-tiered training curriculum covering these domains is proposed here and endorsed by all NGM societies. Tier 1 NGM knowledge and training is expected of all gastroenterology trainees and practicing gastroenterologists. Tier 2 knowledge and training is appropriate for trainees who anticipate NGM disorder management and NGM function test interpretation being an important part of their careers, which may require competency assessment and credentialing of test interpretation skills. Tier 3 knowledge and training is undertaken by trainees interested in a dedicated NGM career and may be restricted to specific domains within the broad NGM field. The joint ANMS and ESNM task force anticipates that the NGM curriculum will streamline NGM training in North America and Europe and will lead to better identification of centers of excellence where Tier 2 and Tier 3 training can be accomplished.

KEYWORDS

curriculum, motility testing, neurogastroenterology

1 | INTRODUCTION

Gastroenterology training has moved successfully to competency-based education in the US, where an organized framework of competencies is utilized to ensure that the trainee has adequate knowledge, skills, attitudes and values to function as a specialist.[1] The benefit of competency-based training includes the facts that education is streamlined using a structured curriculum and that training outcomes are aligned with the trainee's career objectives and societal needs of the field.[1] Gastroenterology consists of several subspecialty fields, including luminal gastroenterology, inflammatory bowel disease, hepatology, biliary disease and pancreatology, and opportunities for subspecialization exist within each of these areas. Trainees recognize the challenges of a general gastroenterological career encompassing all these subspecialty fields, which can include clinical practice, clinical investigation, translational and basic research, and combinations thereof. Within this complex conundrum, gravitation toward a niche area of interest and expertise has become the norm rather than the exception for gastroenterology trainees and practitioners in recent years. One such niche area is neurogastroenterology and motility (NGM), which encompasses the study of the brain, the gut, and how they interact;[2] the trainee is expected to develop an understanding of gastrointestinal motility, pain and sensation within the gut, NGM disorders, and their management. Within the field of NGM, apprenticeships remain the main mode of training both within the US and around the world (Figure 1), with outcomes varying by quality of the training institution and the mentor.[3,4]

Competency-based education requires a description of the scope of training, which has not been systematically evaluated within NGM societies for NGM disorders,[5] despite the fact that NGM is an important component of the gastroenterology curriculum,[6] and entrustable professional activities expected of trained gastroenterologists includes the understanding and management of NGM disorders.[7] In the context of tailoring training components and outcome to trainee and societal needs, the American Neurogastroenterology and Motility Society (ANMS) initiated the idea of defining expectations for NGM training in North America by creating a task force. The project extended to a collaborative joint task force with the European Society of Neurogastroenterology and Motility (ESNM). Members of both the ANMS and ESNM joined forces and deliberated over the training components, in order to establish knowledge, skills, attitudes, and values expected of NGM providers of varying expertise. The fact that this report is not meant to be prescriptive may be a limitation of the process, as the task forces did not try to establish the precise didactic content, rotation structure, and procedure interpretation expectations of NGM training. On the contrary, the task forces jointly agreed that this report needed to be inclusive and broad based, establishing the basis for streamlining NGM training expectations in both North America and Europe, and for potential quality control over procedures and interventions expected of NGM providers. In time, a similar curriculum-based approach could potentially be implemented in other regions of the world, thereby enhancing learning, and striving toward the shared goal of uniformity in NGM training.

2 | A TIERED APPROACH TO NGM TRAINING

As the learning and practice environment has become nuanced and goal directed toward specific GI careers, it is important for educators and educational programs to develop strategies to provide relevant training to the trainee with specific career interests.[8] Consequently, both the educational program and the trainee need to recognize elements of training that are essential to the trainee's career and take ownership of the timing and content of learning.[8] A tiered approach to training serves this purpose, where the trainee is provided training and knowledge that directly relates to what the trainee needs from the training program.

Using tiers of training to allow trainees to gravitate toward their subspecialty niche of interest is not a new concept.[9] The Gastroenterology Core Curriculum describes an 18-month core training (level 1 training) encompassing all aspects of gastroenterology, accounting for half of a 3-year fellowship in gastroenterology in the US.[6] The remainder of the fellowship training provides time for additional training directed toward the trainee's specific area of interest, either clinical, investigative, or laboratory-based, with the expectation of additional skills that will align with the trainee's

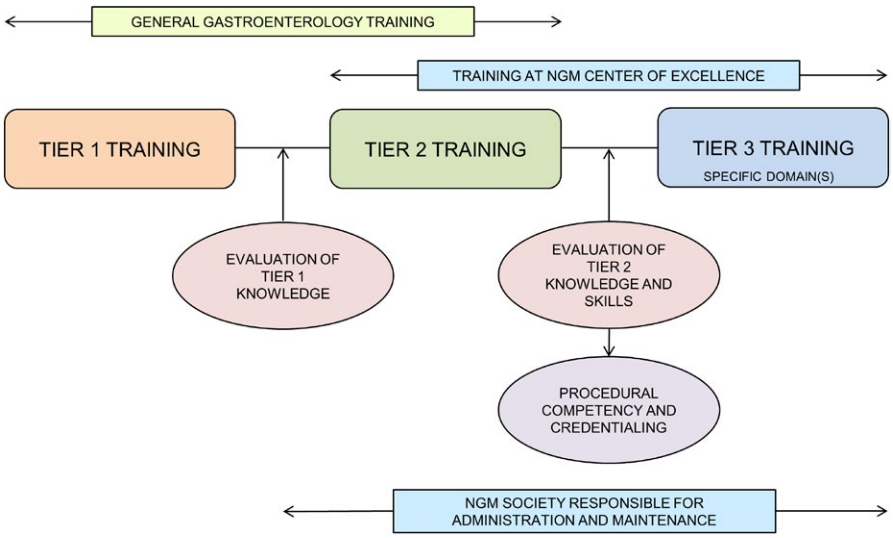

FIGURE 1 Hierarchical tiered system of neurogastroenterology and motility (NGM) training. Broad-based Tier 1 knowledge is expected of all general gastroenterology trainees and practitioners. Tier 2 knowledge and skills are acquired from association with an NGM center of excellence, following adequate demonstration of Tier 1 knowledge. Clinical knowledge and procedural competency can be assessed and credentialed by NGM societies following Tier 2 training. Tier 3 training may be limited to specific domain(s) within NGM and requires additional training beyond general gastroenterology training at an NGM center of excellence. It is anticipated that Tier 2 and Tier 3 training, assessment of Tier 2 competency, and credentialing will be administered and reported by NGM societies

TABLE 1 Tiers of neurogastroenterology and motility training

	Description	Expectations
Tier 1	The general gastroenterologist completing GI specialty training, without special interest in NGM.	• recognize functional and motor disorders that fall within the realm of NGM • order basic investigation and initiate management of these disorders • understand settings where advanced opinion and management are required from Tier 2 or Tier 3 experts
Tier 2	The gastroenterologist with interest and expertise in aspects of NGM, while maintaining a broader gastroenterology interest and practice.	• expectations as outlined for Tier 1 training • perform and interpret function tests pertaining to motor function following special training or apprenticeship within NGM • integrate a multidisciplinary approach to management of NGM disorders • refer complex patients to Tier 3 experts
Tier 3	The neurogastroenterologist and/or motility expert, with a career focus within NGM, and practice limited to NGM disorders	• expectations as outlined for Tiers 1 and 2 training • career interest may be clinical, translational, basic, or combinations thereof, and may either be limited to a particular subarea or anatomic extent within NGM or broad based covering all aspects of NGM • provide expert opinion and management NGM disorders • develop a local, regional, national or international reputation as an expert within aspects of NGM

career goals (level 2 training). A similar concept is envisioned for NGM training, but with three tiers (Table 1), covering three levels of expected expertise in NGM disorders. While the first two tiers can be accomplished within the constraints of a structured fellowship or postdoctoral training program, additional training and experience are typically needed to achieve expertise at the Tier 3 level (Figure 1). While the typical duration of Tier 3 training is 1 year, there are variations, from 3 to 6 months' training in a motility center of excellence, to as long as 2-3 years of mentor-guided research experience in a laboratory serving specific domains within NGM.

Since NGM disorders are among the most frequent conditions encountered in gastroenterology practice,[10,11] it is essential for all gastroenterologists to have a working knowledge of common NGM disorders. This represents Tier 1 NGM training, and components within this tier are expected to be included in the general gastroenterology fellowship training applicable to all fellows (Table 1). The task force carefully considered what is expected of general gastroenterologists, and there was broad consensus that expert interpretation of studies of GI motor structure and function (eg, motility studies) does not fall within this expectation. Instead, general gastroenterologists, and gastroenterologists with other GI subspecialty expertise, are expected to recognize NGM disorders, treat common NGM disorders, understand indications for motor function testing, have knowledge to interpret reports from such motor function testing provided by NGM experts, and be able to either initiate appropriate management or refer patients to NGM experts/surgeons.

The Tier 2 trained gastroenterologist is expected to have received training and instruction in some aspect of NGM, either through apprenticeship or structured training depending on the training environment. This could include training in performance and interpretation of common function studies performed by NGM experts, including but not limited to esophageal manometry, ambulatory reflux monitoring, breath testing for carbohydrate intolerance or small intestinal bacterial overgrowth, and anorectal manometry. Tier 2 training can also include expertise and resources for the use of a multidisciplinary approach for the management of NGM disorders, including recommendations for complementary and alternative therapies. The best available example of Tier 2 training is the Clinical Training Program (CTP) provided by the ANMS, where trainees with interest in NGM are assigned for 1-month observerships in 1 of 10 NGM centers of excellence in the US.[3] A third of trainees enrolled in the nationwide CTP program went on to Tier 3 training and practice,[12] while 9 of 12 motivated trainees at 1 CTP site showed similar interest in NGM.[3] This shows that a dedicated Tier 2 experience can spark in-depth interest in the field, leading to academic careers in NGM.[12]

The Tier 3 trained NGM expert is dedicated to their chosen aspect of NGM, be it clinical practice, clinical research, translational, basic research, or combinations thereof. Tier 3 experience extends well beyond fellowship training and could start with a dedicated NGM fellowship when available. The process of becoming an NGM expert also requires invested experience within the chosen NGM domain, including but not limited to experience in managing NGM patients, reading function studies, leading teaching endeavors, and publishing original research. The Tier 3 trained NGM expert engages in the advanced management of NGM disorders (from diagnosis to medical and endoscopic treatment) and has in-depth comprehension of the NGM field to resolve diagnostic dilemmas and management complications from invasive treatment of NGM disorders. An example of typical Tier 3 training is the 1-year motility fellowship offered by certain US institutions and certain motility centers in Europe; some of these centers may have very specific expertise limited to a single domain or components within a domain. The goal of Tier 3 training in such centers is to achieve broad recognition as an expert typically within specific NGM domains rather than the entire NGM field and to become a thought leader within NGM. However, a broad-based NGM knowledge base may need to be maintained by the Tier 3 NGM experts, extending beyond their own clinical or research focus. Undifferentiated Tier 3 expertise may be the norm rather than the exception in many parts of the world, and the task forces recognize the need to include this provision in the Tier system.

The expectation with the tiered system is that trainees in each tier of training acquire knowledge, skills, attitudes, and values of each preceding tier and the tier of training they are enrolled in. For instance, Tier 3 trainees are expected to have acquired knowledge, skills, attitudes, and values of all the tiers within their specific area of expertise, and Tier 2 trainees are expected to be competent in the Tier 1 curriculum.

3 | CLINICAL KNOWLEDGE COMPONENTS OF THE NGM CURRICULUM

The clinical knowledge elements of the curriculum are divided into domains based on anatomic and categorical areas within NGM. The eleven domains consist of functional gastrointestinal disorders, visceral hypersensitivity and pain pathways, motor disorders within anatomic areas (esophagus, stomach, small bowel and colon, and anorectum), mucosal disorders (gastro-esophageal reflux disease and other mucosal disorders), consequences of systemic disease, consequences of therapy (surgery, endoscopic intervention, medications, and other therapy), and transition of pediatric patients into adult practice (Table 2). These domains may eventually define where Tier 2 and Tier 3 trainees may choose to focus their training, as many of these domains have potential to represent a focused area of expertise for the Tier 3 trainee. Therefore, the Tier 3 trainee or NGM expert may choose to limit their clinical practice and research to one or more domains, but not necessarily all the domains.

The components of each domain are described in Table 2. The description of each domain and the expectations of practitioners achieving each Tier of training within that domain are first described. Following this, the granular components of each domain are further distilled down into the three tiers of training and knowledge.

The task forces were in agreement that NGM training needed to include knowledge and understanding of conditions that could mimic NGM disorders. In particular, mucosal disorders such as

TABLE 2 Clinical knowledge components of the NGM curriculum

1. Functional gastrointestinal disorders	
Description	Functional GI disorders (FGIDs) can present throughout the GI tract and can be associated with almost any GI symptom. These disorders can manifest by themselves or overlap with organic GI disease. The Tier 1 consultant should understand diagnostic algorithms that lead to a functional diagnosis, while maintaining judicious and limited use of diagnostic tests in the diagnosis of functional gastrointestinal disorders. Furthermore, the consultant should become familiar with the use of basic pharmacologic and non-pharmacologic management of FGID, understanding the impact of affective, organic, and psychological stressors. The Tier 2 consultant should become familiar with the concepts of visceral sensation, brain-gut axis, triggering of functional symptoms, and gain experience in the use of advanced pharmacologic and non-pharmacologic approaches for control and management of functional symptoms, including complementary therapeutic modalities. The Tier 3 consultant should have in-depth knowledge of the pathophysiology, manifestations, diagnosis, and management of functional gastrointestinal disorders, and should be able to dissect out the relative contributions of functional vs organic disorders to patient presentation, while integrating pharmacologic and non-pharmacologic management.
Tier 1	• Understand the normal motor and sensory function of the GI tract, pathophysiology of functional GI disorders including motility disturbances, visceral hypersensitivity and psychological factors • Recognize functional esophageal, gastroduodenal disorders, irritable bowel syndrome (including postinfectious IBS), and other functional bowel disorders • Recall conditions that mimic or confound the diagnosis of functional disorders, including infections, inflammation, the concept of alarm symptoms triggering further investigation, and the potential for overlap between organic and functional syndromes • Appreciate the indications, limitations, complications, and cost-effectiveness of diagnostic tests for functional GI disorders • Understand the contribution of affective disorders, anxiety, panic disorder, and depression in the pathophysiology and presentation of functional GI disorders • Appreciate the role of non-pharmacologic management options for functional disorders, including dietary therapy, psychotherapy, and stress reduction • Recall the pharmacology, efficacy, routes of administration, side effects, and appropriate use of medications for functional GI disorders • Recognize morbidity related to functional GI disorders and their management • Understand and apply ROME diagnostic criteria in patient evaluation and management
Tier 2	• Recognize the role of immunology, epithelial barrier, brain gut axis, and the microbiome in functional disorders • Understand the role of complementary and behavioral therapy, hypnotherapy, acupuncture, and diaphragmatic breathing in the management of functional GI disorders • Integrate complementary, psychologic, dietary therapies with psychotropic medications for functional GI disorders • Understand overlap between organic and functional disorders • Interpret breath tests and their diagnostic capability for carbohydrate malabsorption and small bowel bacterial overgrowth
Tier 3	• Understand the interplay between functional GI disorders and non-GI comorbidities (eg, fibromyalgia and migraine) in diagnosis and management of functional disorders • Recognize the contribution of functional GI disorders and visceral hypersensitivity to symptom presentation in organic bowel disorders and provide recommendations for management • Recognize the role of autonomic nervous system in gut function • Integrate multidisciplinary management strategies in functional GI disorders • Develop knowledge to participate in clinical trials and research • Educate other specialists regarding the management of functional GI disorders • Remain abreast of current literature and guidelines within functional GI disorders, including the value of therapies of anecdotal benefit • Integration of psychological and medical care, including care of patients with traumatic life experiences in the context of functional GI disorders
2. Visceral pain	
Description	Visceral pain can be part of several functional and organic GI disorders (eg, diseases of the pancreas) but can also manifest as its own entity. Furthermore, visceral pain can overlap with somatic disorders and can be a consequence of intervention (eg, surgery and endoluminal procedures), part of systemic diseases or result from medication use. In contrast to pain in somatic disorders, visceral pain is characterized by diffuse pain, major autonomic symptoms, referred pain to other visceral and somatic structures, and changing pain characteristics over time. This complicates diagnostics, and additionally, most analgesics have major side effects on the GI tract that need attention by the clinician. The Tier 1 consultant should recognize basic concepts regarding visceral pain, and its recognition in the clinical presentation of symptomatic patients. Furthermore, the consultant should understand the use of analgesics, neuromodulators, and other approaches to managing visceral pain. The Tier 2 consultant should develop expert understanding of pain pathways, become familiar with the concepts of visceral sensation and brain-gut axis, recognize evaluation of rare pain syndromes, and gain experience in the use of pharmacologic and non-pharmacologic approaches for control and management of visceral pain. The Tier 3 consultant should develop in-depth knowledge regarding pain mechanisms, including hollow gut and solid organ pain (such as pain from pancreatic diseases), and provide expert opinion regarding routine, novel, and anecdotal approaches to management of visceral pain.

(Continues)

TABLE 2 (Continued)

Tier 1	• Understand basic sensory function of the GI tract and adjacent solid organs and mechanisms of chronic visceral pain • Recognize the clinical presentation and investigation of other pain syndromes and differential diagnosis of functional abdominal pain (including intestinal ischemia and pain related to pancreatic disorders) • Understand the contribution of affective disorders, anxiety, panic disorder, and depression in the pathophysiology and presentation of functional GI disorders • Recall the pharmacology, efficacy, routes of administration, side effects, and appropriate use of medications commonly used for the management of visceral pain, and abnormal bowel function and pancreatic function related to disorders manifesting with visceral pain • Appreciate the role of non-pharmacologic management options in chronic pain syndromes, including complementary and behavioral therapy, hypnotherapy, acupuncture, dietary therapy, probiotics, diaphragmatic breathing, and stress reduction • Be aware of the effect of opioids and cannabinoids on the gut and their role in pain development de novo and in exacerbating and/or relieving visceral pain • Understand utilization of intestinal secretagogues, prokinetics and peripherally acting mu-opioid receptor antagonists (PAMORAs)
Tier 2	• Develop detailed understanding of pain syndromes, pain pathways and how they affect visceral functions • Recognize the interface between pain presentations and abnormal GI function from organic processes, including intestinal ischemia, pancreatic exocrine and endocrine insufficiency, sphincter of Oddi dysfunction, and retroperitoneal fibrosis • Provide detailed pharmacologic and non-pharmacologic approaches to the management of pain syndromes and their consequences, including motor, exocrine, endocrine and mucosal consequences of disorders associated with visceral pain • Acquire knowledge on when to offer neurolytic procedures, endoscopic and surgical treatment in visceral pain syndromes • Integrate complementary and dietary therapies with psychotropic medications for the management of chronic pain • Develop understanding regarding cognitive behavioral therapy and other psychological approaches in visceral pain management
Tier 3	• Develop detailed knowledge in diagnosis of rare visceral pain disorders, such as Spigelian hernia, abdominal nerve entrapment, porphyria, proctalgia fugax, and abdominal migraine • Be aware of differential diagnoses that may change the pain management such as concomitant peptic ulcers, bacterial overgrowth in the small intestine, and diabetic enteropathy • Acquire knowledge of rare side effects to medication affecting the viscera such as the narcotic bowel syndrome • Differentiate between somatic disorders such as back pain with radiation of pain to the abdomen and referred visceral pain to somatic structures; recognize overlap with pain arising from adjacent intra-abdominal organs including the genitourinary system • Develop knowledge of advanced investigative procedures utilized for evaluation of chronic visceral pain and motility disorders, to exclude organic syndromes and to recognize the overlap of organic disease in chronic visceral pain • Develop expertise to differentiate between nociceptive and neuropathic pain from visceral structures • Develop understanding of quantitative sensory testing to explore disease mechanisms such as central and peripheral sensitization in visceral pain • Recognize experimental treatment of visceral pain, including prokinetics, neuromodulators, psychotropic therapies, vagal nerve stimulation, symptomatic treatments and atypical agents with anecdotal benefit • Obtain experience in leading a multidisciplinary team in managing chronic visceral pain
3. Gastro-esophageal reflux disease	
Description Gastro-esophageal reflux disease (GERD) is one of the most frequent reasons for GI consultation, with both typical (heartburn, regurgitation) and atypical (chest pain, dysphagia, chronic cough, laryngeal symptoms) manifestations and complications (Barrett's esophagus, peptic stricture, esophageal adenocarcinoma). The Tier 1 consultant should recognize the presentation and complications of GERD, utilization of testing in diagnosis and surveillance for complications, and basic management. The Tier 2 consultant should understand the mechanisms of GERD; the indications, basic interpretation, limitations, and complications of diagnostic testing; and provide detailed management of GERD. The Tier 3 consultant should have an in-depth understanding of GERD pathophysiology, performance and expert interpretation of esophageal testing, GERD therapeutics, GERD complications and their management, and provide expert opinion on all aspects of diagnosis and management.	
Tier 1	• Appreciate normal foregut anatomy and pathophysiology, and mechanisms underlying GERD • Comprehend the indications and cost-effectiveness of esophageal testing including diagnostic and therapeutic endoscopy in GERD • Recall the management of GERD, including lifestyle and dietary approaches, medical and invasive management including antireflux surgery, and recognize complications (peptic stricture, Barrett's esophagus) • Appreciate the pharmacology, efficacy, routes of administration, side effects, risks of long-term use and appropriate indication of medications used for treatment of GERD, especially proton pump inhibitors, H2-antagonists, antacids, and ancillary medications • Understand preoperative workup for invasive and surgical management of GERD • Comprehend the utilization of esophageal function test results (including endoscopy, manometry, reflux monitoring, barium studies) in GERD diagnosis and management

(Continues)

TABLE 2 (Continued)

Tier 2	• Describe the detailed presentation, diagnosis, investigation, phenotyping (erosive esophagitis or non-erosive reflux disease), and management of GERD and its complications • Understand specific pathophysiologic abnormalities relevant to GERD diagnosis and management: TLESRs, acid pocket, contraction reserve, HRM metrics in GERD • Acquire knowledge to interpret ambulatory reflux monitoring studies, especially pH monitoring, and esophageal manometry studies performed in the context of GERD • Recognize esophageal disorders that mimic GERD, including disorders of belching and regurgitation • Recognize situations where surgical intervention is indicated for GERD management and identify appropriate indications • Identify complications and risk factors for poor outcome in the management of GERD
Tier 3	• Expert interpretation of esophageal testing in the context of GERD diagnosis and management recommendations, including interpretation of pH-impedance monitoring • Recognize indications and appropriate candidates for endoscopic GERD therapies. • Provide diagnosis and management of complications of GERD management, including GERD recurrence after antireflux surgery • Recognize and provide detailed management of conditions mimicking GERD, including functional syndromes (functional heartburn, reflux hypersensitivity, rumination, and supragastric belching) • Integrate GERD management in patients with comorbidities
4. Esophageal motor disorders	
Description Oropharyngeal and esophageal motor disorders can present with dysphagia, heartburn, regurgitation, aspiration, chest pain, or weight loss. The Tier 1 consultant should understand the basic physiology of normal oropharyngeal and esophageal motor function, common disorders arising from dysfunction, utilization of esophageal function testing to diagnose these disorders, and initial management. The Tier 2 consultant should understand the indications, basic interpretation, utilization, limitations, and complications of diagnostic esophageal motor testing, and management of esophageal motor disorders. The Tier 3 consultant should have a detailed understanding of oropharyngeal and esophageal pathophysiology, provide performance and expert interpretation of esophageal function tests, and coordinate the management of motor disorders and their consequences.	
Tier 1	• Understand the investigation of esophageal symptoms, particularly transit symptoms (dysphagia, esophageal regurgitation) that can lead to a diagnosis of esophageal motor disorders • Differentiate oropharyngeal from esophageal dysphagia and provide appropriate investigation and management, including recommendations for enteral feeding when appropriate • Comprehend diagnostic algorithms for oropharyngeal and esophageal dysphagia and develop knowledge to request appropriate diagnostic testing • Describe the pathophysiology, diagnosis, management, and complications of achalasia • Recognize situations where endoscopic intervention is indicated for the short-term and long-term management of esophageal motor disorders
Tier 2	• Understand in-depth physiology of oropharyngeal and esophageal contractility and peristalsis including neurohormonal regulation of deglutition and overlap with functional disorders • Describe the pathophysiology, diagnosis, management, and complications of major esophageal motor disorders, including EGJ outflow obstruction, aperistalsis, distal esophageal spasm, and jackhammer esophagus • Recognize conditions that may mimic or confound the diagnosis of esophageal motor disorders, including eosinophilic esophagitis, functional dysphagia, esophageal diverticula, organic obstructive syndromes, and gastro-esophageal reflux disease • Appreciate the indications, limitations, complications, and cost-effectiveness of diagnostic esophageal function studies, especially endoscopy, esophageal high-resolution manometry (HRM), and contrast radiography, for the diagnosis and guidance of management of esophageal motor disorders • Recall the pharmacology, efficacy, routes of administration, and appropriate use of medications for esophageal motor disorders • Understand the implications and management of minor motor disorders: ineffective esophageal motility, fragmented peristalsis • Understand the clinical sequelae of motor dysfunction including pharyngeo-esophageal and esophageal diverticula and their management • Recall the pharmacology, efficacy, routes of administration, and appropriate use of medications for esophageal motor disorders • Interpret esophageal manometry studies using the Chicago classification scheme • Provide appropriate use of invasive management options for oropharyngeal and esophageal motor disorders, including enteral feeding options in oropharyngeal motor disorders, endoscopic management including botulinum toxin injection (and with appropriate training, pneumatic dilation) in esophageal motor disorders • Appreciate the indications, limitations, and cost-effectiveness of diagnostic oropharyngeal function studies, especially high-resolution manometry (HRM), contrast radiography, and imaging options for the diagnosis, and guidance of management of oropharyngeal dysphagia • Recognize situations where surgical intervention is indicated for the short-term and long-term management of esophageal motor disorders

(Continues)

TABLE 2 (Continued)

Tier 3	• Develop expertise to select appropriate invasive therapies for the management of complicated esophageal motor disorders (pneumatic dilation, POEM, surgery); perform pneumatic or hydraulic dilation for achalasia; performance of POEM will require advanced endoscopy training to acquire necessary skills, which can last up to a year • Provide expertise, performance, and interpretation of advanced investigative and therapeutic modalities including endo FLIP and postprandial HRM • Understand the evaluation and management of complications, and recurrent symptoms following initial management of motor disorders, especially achalasia • Distinguish overlapping functional esophageal symptoms from motor disorders and provide management recommendations • Provide opinion and expert management of oropharyngeal and esophageal motor disorders within the context of age and comorbid conditions • Recognize appropriate patients for complementary and adjunctive therapies for motor disorders, such as swallow exercises, cognitive and behavioral therapy, and hypnotherapy
5. Gastric motor disorders	
Description	Gastric motor function involves the complex modulation of neuromuscular activity through the central, autonomic, and enteric nervous systems, the interstitial cells of Cajal, and various neurotransmitters. Gastric motor disorders can present with nausea, vomiting, early satiety, postprandial distress, abdominal pain, bloating, and weight loss. The Tier 1 consultant should develop an understanding of the physiology of gastric neuromuscular function, diagnosis and management of common disorders arising from dysfunction, especially functional dyspepsia, gastroparesis, and vomiting syndromes. The Tier 2 consultant should have detailed understanding of gastric motor disorders and their presentation and should be able to interpret and utilize diagnostic tests (especially gastric scintigraphy) for the initial management of gastric motor dysfunction, including dietary, pharmacologic, and surgical interventions. The Tier 3 consultant should recognize the implications of gastric motor dysfunction and its consequences in the context of comorbid conditions and past management, provide expert interpretation of all aspects gastric motor testing, and lead multidisciplinary teams for the advanced non-invasive and invasive management of gastric motor disorders.
Tier 1	• Recognize gastric anatomy and physiology, gastric histology, the physiology of normal gastric neuromuscular function including gastric emptying and gastric visceral sensation • Describe the natural history, epidemiology, pathophysiology, and complications of common gastric motor disorders, including gastroparesis and rapid emptying, and vomiting disorders • Appreciate the indications, limitations, cost-effectiveness, and implications of motility testing in the diagnosis and management of suspected gastric motor disorders, including upper endoscopy, contrast radiography, and gastric scintigraphy • Recall the pharmacology, efficacy, side effects, routes of administration, and appropriate use of medications used in the treatment of gastric motor disorders • Recognize conditions that may mimic or confound the diagnosis of gastric motor disorders, especially functional dyspepsia • Understand the utility of non-pharmacologic interventions including nutritional and dietary management for gastric motor disorders • Recognize indications for invasive management in gastric motor disorders
Tier 2	• Understand detailed physiology and pathophysiology of gastric motor function and dysfunction and mechanisms of gastric visceral sensations • Describe presentation, diagnosis, and management of less frequent gastric motor disorders, including rapid emptying, dumping syndrome and reactive hypoglycemia • Provide dietary and adjunctive management of gastric motor disorders, including nutrition and dietary management, and complementary approaches
Tier 3	• Understand the clinical value, indications and interpretation of advanced motor evaluation of gastric motor function, including antroduodenal manometry, electrogastrography, and wireless motility capsule • Recognize clinical indications and contraindications for advanced and invasive management of gastric motor disorders, including gastric neurostimulation, pyloric botulinum toxin injection, venting gastrostomy, feeding jejunostomy, and gastric peroral endoscopic myotomy (GPOEM) Performance of GPOEM will require additional advanced endoscopy training for up to a year • Develop detailed understanding to provide expert consultation and management of complex gastric motor disorders within the context of comorbidities, past interventions including surgery, complications, and psychiatric disorders • Integrate multifaceted management of gastric motor disorders and coordinate a multispecialty team including dieticians, health psychologists, nutritionists, and surgeons • Utilize advanced and novel clinical and research modalities in evaluation and management of gastric motor function
6. Small bowel and colonic motor disease	
Description:	Small bowel motor diseases, including pseudo-obstruction and intestinal failure, are infrequently encountered abnormalities, which may present with abdominal distension, ileus, vomiting, feeding intolerance, diarrhea, or abdominal pain. Colonic motor disorders are more common and can present with constipation, diarrhea, abdominal distention, nausea, and abdominal pain. The Tier 1 consultant should understand the clinical presentation and course of small bowel and colonic motor diseases, conditions that may mimic or confound their diagnosis and the indications, basic testing, as well as the initial management of these disorders including diet, medications, surgical, and supportive care. The Tier 2 consultant should understand advanced diagnostic procedures including laboratory tests, specific imaging modalities, assessment of motor function and knowledge regarding standard and non-standard treatment options. The Tier 3 consultant should develop expert knowledge in unraveling advanced motility disorders using complementary tests and have knowledge in the use of advanced treatment options of difficult cases including surgical options, intestinal transplantation, and advanced nutritional support.

(Continues)

TABLE 2 (Continued)

Tier 1	• Develop a basic understanding of physiology of small intestine and colonic function including motor function, mucosal function, absorption of nutrients, and symptoms arising from dysfunction of the small bowel and colon • Review potential primary and secondary causes, clinical presentation and initial management of acute (ileus) and chronic small bowel, and colonic motor disorders • Recognize differential diagnosis of acute motor dysfunction of the small bowel and colon, including small bowel obstruction, strictures, volvulus, and ischemia • Recall the pharmacology, efficacy, routes of administration, and appropriate use of standard medications for small bowel and colonic motor disorders, including medications for management of chronic constipation and diarrhea • Recognize conditions that may mimic or confound the diagnosis of small intestinal, pancreas, and colonic motor disorders, including small intestinal bacterial overgrowth, functional gastrointestinal disorders, outlet constipation, diverticular disease, and inflammatory disorders (inflammatory bowel disease, celiac disease, radiation enteritis, infectious colitis, microscopic colitis, etc.) • Recognize the role for breath hydrogen testing for carbohydrate intolerance (lactose, fructose, and sucrose intolerance), and small bowel bacterial overgrowth in patients with abdominal symptoms • Understand nutritional support options for patients with small bowel motor disorders (especially pseudo-obstruction) • Appreciate the indications, limitations, complications, and cost-effectiveness of studies assessing gut transit, particularly the use of radio-opaque markers • Recognize situations where endoscopic and/or surgical intervention is indicated for the short- and long-term management of small bowel and colonic motor disorders
Tier 2	• Understand detailed pathophysiology of acute and chronic motor disorders of the small bowel and colon, including their differential diagnosis • Develop knowledge on the indications for endoscopic and surgical options for the management of small bowel and colonic motor disorders • Provide interpretation of breath tests for carbohydrate intolerance and small bowel bacterial overgrowth in difficult and atypical cases • Recognize the role of systemic disease, side effects of medications and consequences of bowel surgery as a mechanism for small bowel and colonic motor dysfunction and bowel transit symptoms • Recognize implications of pancreatic endocrine insufficiency (diabetes with gastroparesis/autonomic dysfunction) and secondary motility disorders (eg, systemic sclerosis and spinal cord injuries) on patient presentation and investigation • Recognize the clinical value of imaging and scintigraphic modalities in the diagnosis and management of small bowel and colonic motility disorders • Develop knowledge in the use of advanced pharmacological and non-pharmacological treatments of motility disorders and including the use off-label drugs
Tier 3	• Understand the function of gut peptides and their role in gut motor and secretory function • Develop the understanding and experience in advanced assessment of small bowel and colonic motor function, including wireless motility capsule, antro-duodeno-jejunal motility testing, colonic motility testing, scintigraphy, and novel techniques • Develop expertise in advanced management of nutrition needs, including enteral and parenteral nutrition and its complications, utilization of surgical ostomy in management of small bowel and colonic motor disorders • Recognize experimental treatment of common and rare small bowel and colonic motor disorders, including prokinetics, neuro-modulators, symptomatic agents, and atypical agents • Recognize patients who might benefit from small bowel transplantation, ostomy, and colectomy for advanced and complex small bowel and colonic motor disorders

7. Pelvic floor disorders

Description

Pelvic floor disorders encompass a variety of disorders and can present with symptoms related to constipation (straining, splinting, and incomplete evacuation), fecal incontinence (unintentional passage of flatus, and stool seepage), and pain (abdominal distention and pelvic pain). Pelvic floor disorders have a significant impact on quality of life and can lead a debilitating course. Pelvic floor disorders are of multifactorial origin and cover a wide spectrum of recognized mechanisms and incompletely understood pathophysiology. The Tier 1 consultant should understand the basic anatomy and physiology of the pelvic floor, diagnostic criteria for common pelvic floor disorders (functional defecatory disorders and fecal incontinence) including overlap of structural and functional disease, indications for diagnostic studies and both pharmaceutical and non-pharmaceutical options (biofeedback). Tier 2 consultants should become familiar with performing and interpreting anorectal diagnostics, learn the role, limitations, and caveats of anorectal surgical procedures, and understand complex medical pelvic floor disorders (pelvic pain disorders and neuromuscular disease). Tier 3 consultants should be familiar with state of the art manometric, radiologic, ultrasound and barostat-based anorectal diagnostics, develop expertise in collaboration with associated specialties to integrate management of patients with difficult, therapy-refractory, and structurally disrupted pelvic floor disease secondary to trauma, birth defects, neuromuscular disorders, and surgical complications.

(Continues)

TABLE 2 (Continued)

Tier 1	• Understand the physiology and anatomy of the pelvic floor • Understand the pathophysiology, diagnosis, management, and complications of pelvic floor disorders (functional defecatory disorders, pelvic pain disorders, and fecal incontinence) • Recognize conditions that may mimic, confound, or exacerbate functional defecatory disorders and fecal incontinence including IBS, chronic diarrhea, fecal impaction, rectal prolapse, functional constipation, colorectal cancer, stricture, anal stenosis, anal fissures, extrinsic compression, and rectocele • Be familiar with the indications for diagnostic anorectal studies, such as anorectal manometry with balloon expulsion and defecography in the diagnosis and guidance of management of pelvic floor disorders • Recall the pharmacology, efficacy, routes of administration, and appropriate use of medications for pelvic floor disorders, including the management of fecal incontinence • Understand the role of biofeedback therapy in the treatment of pelvic floor disorders • Describe basic pharmacological management of constipation and fecal incontinence
Tier 2	• Become familiar with the interpretation of diagnostic anorectal studies, such as balloon expulsion test, anorectal manometry, and defecography in the diagnosis and guidance of the management of pelvic floor disorders • Understand the pathophysiology and treatment approaches (medical, physiotherapy, and surgical) for pelvic pain disorders • Recognize neuromuscular disorders and understand the consequence of birth defects with and without corrective surgery and trauma • Learn about surgical procedures of the anorectum and their caveats • Recognize situations when surgical intervention (correction of enterocele, rectocele, and prolapse) is indicated and contraindicated for the management of pelvic floor disorders • Describe advanced pharmacologic and non-pharmacologic treatment of constipation and fecal incontinence • Comprehend management of therapy-refractory fecal incontinence (including indication for referral to sacral nerve stimulator implantation) • Recognize conditions that may mimic, confound, or exacerbate pelvic pain disorders such as proctalgia syndromes and interstitial cystitis
Tier 3	• Develop knowledge and expertise in interpretation of advanced anorectal tests including HRM and 3DHRM, electromyography, MRI defecography, endo-anal ultrasound, barostat balloon testing (for rectal compliance, volume and and sensation), and neurophysiology (including electromyography, translumbar and transsacral motor-evoked potentials) • Customize biofeedback recommendations based on manometric and other test findings • Understand indications for sacral nerve stimulation for fecal incontinence and surgical management of pelvic floor disorders • Indication of surgical management for pelvic floor disorders • Coordinate with urologists, urogynecologists, gynecologists, colorectal surgeons, physical therapists, and radiologists in managing pelvic floor disorders • Develop expertise in the indications and limitation of highly specialized treatment options for anorectal disorders including injection of bulking agents and use of anorectal devices (SNS, TENS) • Provide integrated management of difficult/therapy-refractory patients in a pelvic floor center
8. Mucosal disorders of the Gut	
Description	Mucosal disorders are important in that they may mimic or coexist with functional and motor GI disorders. Foregut mucosal disorders include GERD, eosinophilic esophagitis, and peptic ulcer disease manifesting with heartburn, regurgitation, dysphagia, chest and epigastric, bloating, early satiety, nausea, weight loss, or their complications such as upper gastrointestinal bleeding and perforation. Small bowel and colonic mucosal disorders include celiac disease, inflammatory bowel disease, gastroenteritis and infectious colitis, radiation enteritis, and other less common inflammatory conditions, manifesting as alteration of bowel function, bloating, and abdominal pain. The Tier 1 consultant should understand the evaluation of gut symptoms, particularly the indications, basic interpretation, utilization, limitations, and complications of testing in the context of mucosal disorders and the basic management gut mucosal disorders. The Tier 2 consultant should recognize the overlap of mucosal disorders with functional disorders and symptoms, and understand appropriate evaluation and management of mucosal disorders. The Tier 3 consultant should have in-depth understanding of the presentation and diagnosis of mucosal disorders of the gut and recognize the interface between organic and functional disorders in managing symptoms from overlapping mucosal disorders.
Tier 1	• Appreciate normal gut morphology and function, pathophysiology and mechanisms underlying mucosal protective mechanisms, and pathophysiology of gut mucosal disorders that share symptoms with functional bowel disorders. • Recognize the indications, limitations, complications, and cost-effectiveness of diagnostic and therapeutic endoscopy and diagnostic testing for *H. pylori* • Understand the diagnosis and basic management approaches for eosinophilic esophagitis • Understand the diagnosis and basic management of infectious (candida, HSV, and CMV) and inflammatory (radiation, caustic ingestions, and pill-induced) esophagitis • Understand the etiology, pathogenesis, diagnosis, complications, and management of peptic ulcer disease (including indications for surgery) and recognize conditions that mimic or confound the diagnosis • Recognize inflammatory and infectious disorders of the small bowel and colon (eg, inflammatory bowel disease, celiac disease, radiation enteritis, infectious colitis, and microscopic colitis)

(Continues)

TABLE 2 (Continued)

Tier 2	• Understand pathophysiology and detailed management of EoE, and other mucosal disorders, including dietary and endoscopic intervention when indicated • Comprehend the management and surveillance of abnormal mucosal pathology such as gastric intestinal metaplasia, atrophic, and autoimmune gastritis • Identify complications and risk factors for poor outcome in management of peptic ulcer disease and other gut mucosal disorders
Tier 3	• Provide advanced management of refractory eosinophilic esophagitis and other esophageal mucosal disorders • Understand physiology of gastric acid secretion and provide expert interpretation of gastric testing, including gastrin levels, secretin stimulation, and gastric acid analysis • Provide consultative services and second opinions on complex patients with mucosal processes overlapping with functional bowel disease • Provide management recommendations based on expert interpretation of advanced testing (ie, endoflip) • Provide innovative, novel, and advanced investigation and therapy of mucosal disorders • Identify and manage gastric acid hypersecretory diseases including antral G-cell hyperplasia, Zollinger-Ellison syndrome, multiple endocrine neoplasia type I (MEN 1), systemic mastocytosis, short bowel syndrome, hyperparathyroidism, and cystic fibrosis
9. Consequences of endoscopic intervention and surgery	
Description Surgery involving the GI tract has consequences on motor, sensory, and mucosal function. In the present day, advanced endoscopic intervention is performed akin to minimally invasive surgery (eg, peroral endoscopic myotomy and transoral incisionless fundoplication) with similar consequences as surgery. The Tier 1 consultant should understand the anatomy and physiology of the GI tract and how this is disrupted by surgery. The Tier 1 consultant should also understand the indications, limitations, and complications of surgical procedures of the GI tract. The Tier 2 consultant should have knowledge on advanced diagnostic procedures and treatment possibilities for consequences to surgery. This includes imaging and motility assessment and pain assessment and interpretation of laboratory tests. The Tier 3 consultant should obtain the highest expert function in unraveling surgical complications and have knowledge in the use of more advanced treatments of difficult cases including visceral pain following surgery.	
Tier 1	• Recognize potential complications, both short- and long-term, of surgical interventions for gastro-esophageal reflux disease (such as Nissen, Toupet, and Dor fundoplication), including dysphagia, abnormal gastric emptying, gas bloat, and dumping syndrome • Recognize consequences of bariatric surgery • Recognize consequences following cholecystectomy including dyspepsia, diarrhea, and postcholecystectomy syndrome • Describe symptoms suggestive of intestinal dysfunction following midgut or hindgut surgery • Identify potential physical and metabolic mechanisms of postsurgical dysfunction including stricture, segmental dilation, motor and sensory nerve disruption, and small intestinal bacterial overgrowth • Understand the basis for medical treatment of the most common surgical complications
Tier 2	• Describe the pathophysiology, clinical manifestations, and management of esophageal and gastric motor disorders following bariatric surgery (sleeve gastrectomy, laparoscopic banding, and Roux-en-Y gastric bypass), including motor, sensory, and nutritional consequences • Recognize potential complications, both short- and long-term, of surgical interventions (such as myotomy and POEM) for the management of esophageal motor disorders • Describe pathophysiology, clinical manifestations, and management of peptic ulcer disease surgery (gastrectomy/vagotomy), bowel resection, and Whipple procedure. • Understand basic techniques of midgut and hindgut surgery including ostomies and management of their long-term sequelae including high ostomy output • Describe consequences of anorectal surgery (eg, ileo-anal pouch) • Recognize the role of endoscopy, radiography, manometry, and transit studies in evaluation of postsurgical symptoms • Recognize diagnosis and treatment of motility disorders following surgery • Develop knowledge in the pathophysiology and treatment of neurogenic pain following surgery
Tier 3	• Develop expertise in understanding the consequences of endoscopic bariatric surgery, transesophageal incisionless fundoplication, NOTES procedures, and other endoluminal invasive therapies and provide direction in planning management • Recognize and manage esophageal and gastric consequences of lung transplantation. • Provide expertise in assessment of colonic and anorectal function prior to restoring continuity of the GI tract • Have expert knowledge in medical treatment of surgical complications including experimental therapies and management of chronic pain following surgery • Interpret physiologic studies in postoperative patients • Provide advanced management of postfundoplication syndromes, postmyotomy syndromes, and other postsurgical syndromes • Understand historical perspectives regarding obsolete surgical and invasive procedures that patients might have undergone in the past

(Continues)

TABLE 2 (Continued)

10. Consequences of systemic disease, medications, and radiation therapy	
Description	Consequences of systemic disease and medications can pose significant morbidity and the clinical presentation can be varied. The use of medications can affect gastrointestinal motility resulting in new onset or worsening symptoms, dysmotility, and dysfunction. The Tier 1 consultant should understand the potential implications of systemic diseases and medications on GI motor function and functional bowel disease. The Tier 2 consultant should also understand the indications, utilization, limitations, and implications of diagnostic testing, and the initial management of systemic disease and medications that impact GI motility. The Tier 3 consultant should develop in-depth understanding of pathophysiology of systemic disease affecting bowel motor function and provide expert consultation regarding risk vs benefit of medications with potential gastrointestinal motor consequences
Tier 1	• Understand the most common systemic diseases and their impact on GI motor function and functional bowel disease • Be aware that connective tissue disorders such as scleroderma, paraneoplastic disorders, neuromuscular disorders, and endocrine disorders such as diabetes affect GI motility • Recall the pharmacology, mechanism of action, and the effect of current and past use of medications that impact GI motility, such as opioids, chemotherapy, and anticholinergic agents. • Understand the timeline, presentation, diagnosis, management, and complications of radiation injury to the GI tract, such as dysmotility, stricture, ulceration, bleeding, fibrosis, and fistula • Recognize situations where surgical and nutritional intervention is indicated for the management of systemic diseases that affect the GI tract. • Recognize the effects of opioids, cannabinoids, and recreational drug use on gut symptoms and motor function
Tier 2	• Describe the pathophysiology, diagnosis, management, and complications of systemic diseases such as connective tissue disorders, paraneoplastic dysmotility, autoimmune disorders, hypothyroidism, amyloidosis, infections, connective tissues diseases, mitochondrial diseases, muscular dystrophy, endocrine and metabolic disorders, autonomic neuropathies, central nervous system diseases including Parkinson's diseases and intracranial masses, sepsis, malnutrition, and renal insufficiency • Understand in depth the effect of current or past treatments on GI motor function and functional bowel disease including chemotherapy, radiation, opioids, antiparkinsonian medications and isoniazid, tricyclic antidepressants, phenothiazines, and proton pump inhibitors • Be familiar with the indications, limitations, complications, and cost-effectiveness of diagnostic studies, such as manometry, GI transit studies, endoscopy, and imaging studies for the diagnosis and guidance of the management of systemic diseases that affect GI motility • Understand the management of consequences of effects of opioids, cannabinoids, and recreational drug use on bowel function
Tier 3	• Interpret physiologic tests and provide context in patients with systemic disease • Provide opinion regarding medication effects on gut mucosal and motor function • Make recommendations for surgical and nutritional intervention in systemic diseases affecting the GI tract • Understand the role of discontinuation of redundant or unnecessary medications that affect gut function • Provide expert opinion and management of narcotic bowel syndrome, cannabinoid hyperemesis syndrome, consequences of opioid usage, and drug-seeking behavior
11. Pediatric transition to adult neurogastroenterology	
Description	Pediatric neurogastroenterology has higher proportions of congenital motor and metabolic disorders, perinatal neurological or gastrointestinal injuries compared to adults, the need to obtain history from parents to caregivers, and significant influence of family and peers on the illness experience. Some congenital- and childhood-onset disorders and aspects of pediatric care are relevant to the adult gastroenterologist as children transition to adulthood and seek medical evaluation and treatment. The Tier 1 consultant should understand basic aspects of pediatric gastroenterology and facilitate the transition of care of adolescents with chronic diseases/disorders to the adult gastroenterologist, integrating the entire life cycle. The Tier 2 consultant should have a deeper understanding of pediatric neurogastroenterology and will need to develop skills and expertise to manage routine neurogastroenterologic disorders in adolescents and young adults transitioning to adult care. The Tier 3 consultant should have expertise in neurogastroenterologic disorders afflicting adolescents and young adults and should seamlessly transition care of even complicated pediatric neurogastroenterology and motility disorders that continue into adulthood.
Tier 1	• Understand diseases that start in childhood and continue into adulthood (eg, Hirschsprung, anorectal malformations, tracheo-esophageal fistula/esophageal atresia, functional constipation, irritable bowel syndrome, functional dyspepsia) • Understand risk factors for FGIDs including early life events and the role of family, school, and peers in the onset and course of pediatric FGIDs • Understand that developmental stage, physiologic changes in adolescence, and psychosocial dynamics are integral to care of pediatric patients • Understand that effective transition is a process involving the patient, family, and pediatric and adult medical providers • Recognize that for the patient, seeing an adult provider is a novel experience and style of practice and expectations may differ from pediatric care

(Continues)

TABLE 2 (Continued)

Tier 2	• Recognize that diagnostic criteria and terminology may differ between children and adults, and there are disorders exclusively diagnosed in pediatrics (pediatric aerophagia, functional abdominal pain—not otherwise specified (FAP-NOS), abdominal migraine) • Comprehend differences inherent to pediatric and adult care, including length and frequency of visit, family involvement in care and patient independence, insurance, and patient's need to advocate for self • Develop skills needed to effectively transition adolescents and adults with simple neurogastroenterology and motility disorders into adult clinical practice
Tier 3	• Understand unique aspects of diagnostic criteria for children with FGID • Transition complex pediatric and adolescent patients with chronic mucosal, motor, and functional disorders efficiently into adult neurogastroenterology practice • Understand sequela of the past medical and surgical treatments for chronic motor and functional diseases in children and adolescents • Understand historical perspective regarding obsolete surgical and invasive procedures that patients might have undergone in the past • Recognize that the young adult may seek independence from family participation in their care, address concerns and allay anxiety in both patients and family members • Provide guidance, expertise, and insight into management of disorders of neurogastroenterology and motility in adolescents and young adults

eosinophilic esophagitis, Helicobacter pylori gastritis, and other gastric mucosal pathology, celiac disease, and microscopic colitis needed to be within the radar of NGM expertise. It was evident that there were differences in expectations of NGM training between countries, and that some countries had broader expectations for knowledge and expertise in conditions mimicking NGM disorders. For instance, pancreatic pain and understanding of pancreatic exocrine insufficiency were considered part of NGM knowledge in some European countries, contrary to US training where pancreatic disorders are typically managed by pancreaticobiliary experts. In recognition of these differences, the curriculum content is broad and inclusive, so that it can be applicable to as many settings as possible. The expectation is that each country and NGM society utilizing the curriculum can adapt content to their specific requirements.

The task forces discussed pediatric disorders and training at length with pediatric experts engaged in the curriculum project. The overall

TABLE 3 Expected skills, attitudes, and values within a tiered training system

Tier	Skills	Attitudes and values
Tier 1	• Obtain relevant and age-specific history relative to functional bowel disorders, motor disorders, and other related disorders pertaining to neurogastroenterology and motility • Perform a directed physical examination including a digital rectal examination aimed at excluding organic disorders that mimic or overlap with functional or motor disorders • Understand when physiologic studies, radiologic and nuclear medicine studies, colonoscopy, and breath tests are needed in the evaluation of functional bowel disorders, motor disorders, and other disorders pertaining to neurogastroenterology and motility; make referrals for these tests for the diagnosis and management of functional bowel disorders • Generate an appropriate differential diagnosis for clinical presentations of neurogastroenterology and motility disorders • Collaborate with patients and families in the care of patients with functional bowel, motor, and mucosal disorders pertaining to neurogastroenterology and motility; explain the limited role for further diagnostic testing; reassure and empower patients • Help patients identify possible dietary triggers (eg, gluten, lactose, fructose, sorbitol, FODMAP) for their functional bowel disorder symptoms; formulate a referral to a dietician regarding initiation of a particular diet (eg, FODMAP and gluten-free) to manage symptoms in a patient with functional bowel disorder • Recognize the effects of aging on functional bowel disorders and gastrointestinal motor function • Communicate effectively with families as they play an integral role in the lives of many adolescents, young adults, older adults, and elderly patients and are frequently involved in clinical encounters in health care	• Share compassion and understanding when addressing the often disabling symptoms associated with adult and pediatric onset functional and motor disorders • Cooperate with pharmacists, surgeons, speech pathologists, nutritionists, health psychologists, and motility nurses/technicians in the diagnosis and management of functional and motor disorders • Achieve appropriate understanding and communication skills to present the information to the families based on an integrative approach and the biopsychosocial model of diseases • Demonstrate sensitivity, patience, compassion, gender, ethnic, cultural, and socioeconomic sensitivity and ethical principles in choice of management options for these disorders, including pediatric onset disorders • Counsel patients, families, and caregivers utilizing language and resources appropriate to their health literacy

(Continues)

TABLE 3 (Continued)

Tier	Skills	Attitudes and values
Tier 2	• Determine possible triggers for exacerbation of symptoms and impact of functional bowel disorders on quality of life, physical and psychological growth; screen patients who would benefit from referral to a psychologist • Develop skills to interpret basic tests of motor function, including esophageal manometry, pH testing, gastric emptying studies, anorectal manometry, breath testing for SIBO, and carbohydrate intolerance • Effectively educate young adult patients and, if indicated, their caregivers on similarities and differences between pediatric diagnostic criteria and treatment compared to adult, while considering that maturity and health literacy may vary widely independent of age • Communicate the long-term course of neurogastroenterologic disorders from childhood to adulthood, and the relevance of the pediatric medical history in the understanding of clinical manifestations during adulthood • Develop knowledge to design and participate in clinical trials	• Provide consultation and advice regarding the management of functional GI and motility disorders to both patients and other physicians • Provide multidisciplinary diagnostic and management services for functional GI and motility disorders • Comprehend the impact of functional GI and motility disorders in the context of other GI and non-GI disorders and develop management strategies that are both short- and long-term options • Understand the role of complementary and adjunctive therapy for functional GI and motility disorders; coordinate care with providers who have expertise in these areas • Recognize the effect of medications and systemic disease on functional GI and motility disorders
Tier 3	• Develop mastery over interpretation of tests of motor function, including advanced and investigational tests, in the context of presenting symptoms and differential diagnosis • Comprehend the natural history of neurogastroenterologic and motor disorders, and apply this knowledge to the management of these disorders including counseling of patients and families • Develop expertise in novel, advanced and experimental diagnostic and management options for functional GI and motility disorders • Communicate the role of diet, lifestyle factors, affective disorders, and other modifiers of symptoms in patients with functional GI and motility disorders • Understand that effective transition is a process involving the patient, family, and pediatric and adult medical providers. This process should include obtaining and reviewing the past medical records and communicating directly with the pediatric gastroenterologist in order to enhance comprehension of the patient's medical disorder, transition readiness, and specific needs • Understand and develop standard operating practices (technical and medical) for physiologic testing laboratories and centers of excellence • Strive to achieve thought leader status within the field	• Provide expert consultative services, intuitive second opinions, and tertiary care complex patients • Develop and lead multidisciplinary teams in managing functional GI and motility disorders • Develop knowledge and infrastructure to initiate original research and participate in clinical trials pertaining to functional GI and motility disorders • Seek education on experimental and anecdotal management options for functional GI and motility disorders • Educate other specialists regarding pathophysiology, diagnosis and management of disorders of neurogastroenterology, and motility

conclusion was that pediatric and adult practices differ widely in their disease content. Similar to core specialty training differences, NGM training requirements are different enough between pediatric and adult practices that a single curriculum would not do justice to either adult or pediatric NGM training.[6,13] Instead, the curriculum needs to be replicated within the pediatric spectrum in order to highlight unique elements of pediatric training that are different from expectations from adult NGM training, since pediatric NGM training is only addressed in a very limited fashion in the pediatric GI curriculum.[13] One area of importance to adult NGM training consists of transition of pediatric patients into adult practices. Adult NGM training currently lacks not only training components that focus on transition elements that incorporate unique knowledge components but also unique skills, attitudes, and values that are needed to address the transition (Table 3). This transition to adult care needs specific training, understanding of common pediatric diagnoses, attention to the patient's variable knowledge and skills to manage disease independently, and recognition of the role of parents and caregivers in the care of younger patients.

4 | SKILLS, ATTITUDES, AND VALUES

NGM training involves not just clinical knowledge but also training in procedural skills and adoption of compassionate attitudes and values in evaluation and management of complex patients, many with psychological comorbidities and poor quality of health. The expected skills, attitudes, and values expected of each tier of NGM training are described in Table 3.

Special listening skills, compassion, and empathy are essential qualities of all physicians, but these qualities are especially desirable of NGM experts, as NGM disorders are associated with significant impairment of health-related quality of life, with multiple disease determinants including life stress, early adverse life events, poor coping skills, lack of social support, adjunctive affective disorders, extraintestinal epiphenomena of NGM disorders, and organic conditions mimicking or overlapping NGM disorders.[14] While some of these skills are taught and evaluated within the 6 competencies addressed during residency and fellowship

training in the US (professionalism, interpersonal and communication skills, problem-based learning and improvement, systems-based practice), experience in patient care within the field of NGM and observing NGM experts interacting with patients play an important role in the further development of the trainee's skills, attitudes, and values.[9] Many of these skills and attitudes require a multispecialty approach and collaboration with psychologists, psychiatrists, nutritionists, and other providers with skills in cognitive and behavioral therapy, acupuncture, and hypnosis.[15,16] The task forces felt that trainees acquire these skills in a tiered fashion, with a higher degree of investment, understanding and acquisition of such skills and attitudes with deeper involvement in NGM, which could include spending time at an NGM center of excellence. In particular, transition of pediatric NGM patients into adult practices requires special skills that need special attention and experience during each tier of training (Table 3).

Since NGM expertise involves the interpretation of gut function and motility studies, the task forces carefully assessed these components of training. There was unanimous agreement that specific training and expertise were needed for interpretation of gut function and motility studies, and that such expertise was outside the realm of the Tier 1 trainee. Instead, the Tier 1 trainee needed to understand when to order these studies,[12] and how to interpret and act on reports provided by the Tier 2 and Tier 3 experts. The Tier 2 trainee could acquire skills and knowledge for interpretation of gut function and motility studies by participating in specialized training. In the US, such training can be achieved from fellowship training in a center of excellence with motility expertise,[17,18] from participating in a Tier 2 CTP,[3,12] or from a Tier 3 motility fellowship. In Europe, this is currently achieved by apprenticeship (3 months to 2 years) at a training center with motility expertise, but there are significant differences in duration and organization between countries, including other parts of the world such as Latin America and Asia. In France, for instance, a university diploma is available for 'functional digestive disorders' even though NGM is not necessarily recognized as an independent subspecialty, and this diploma is not required for clinical practice within NGM. In several other countries including the United Kingdom, NGM function studies and their interpretation can be performed by 'physiologists' and specially trained nurses, who may also recommend treatment within their areas of expertise. Therefore, it is anticipated that the curriculum can be adapted to these special circumstances to ensure quality of the NGM services provided. Furthermore, the 1-month CTP is only the point of initiation of advanced training and may not be adequate for interpretation of all gut function and motility studies; limited data available suggest that skills in interpretation of breath tests and anorectal manometry are the simplest to acquire, but interpretation of other function tests is more complex.[3] The Tier 3 trainee is expected to gain skills in advanced interpretation of gut function and motility studies relevant to their chosen NGM domain(s) of expertise.

The advanced NGM trainee is expected to be involved in investigation and scholarly activity, and in writing, presentation, and publication. These are essential tenets of a successful NGM career and thought leader status. Consequently, training in NGM requires involvement of mentors at all tiers of training, who can guide the trainee in identifying and achieving their career goals.

5 | EVALUATION OF OUTCOME

The success of an NGM training program can be assessed by the ability of the trainee to function as a specialist or consultant within NGM, providing appropriate care and consultative services for NGM patients, interpreting NGM function studies, directing an NGM testing facility, performing research within NGM, mentoring of future trainees, and becoming a thought leader in the field.[9,12] While many of these metrics do not lend themselves to easy measurement tools, clinical knowledge and interpretation skills can be evaluated, and career trajectories can be followed over time.

The ANMS has an ongoing CTP for Tier 2 training in NGM, in existence for over a decade.[3,12] The CTP program currently administers a 60 multiple choice question test before and after the 1-month observership, and significant increments in test scores are reported between pre- and post-CTP scores.[3,12] However, trainees and training institutions both indicate that the 1-month CTP apprenticeship is not long enough for a robust training experience,[12] and that the outcome of the experience is highly dependent on the enthusiasm and enterprise of the trainee and the resources at the mentoring institution. Nevertheless, the limited outcome data available suggest that at least a third of CTP trainees desire further involvement in the field of NGM, and many move on to successful careers in NGM.[3]

Tier-based testing is proposed for use with the new Tiered NGM curriculum. The ANMS has compiled an updated question bank of multiple choice questions applicable to Tier 1 and Tier 2 knowledge. It is proposed that trainees be competent in Tier 1 NGM knowledge prior to enrollment in Tier 2 programs, which can be tested by applying a Tier 1 questionnaire on application for a Tier 2 program such as the ANMS CTP. Learning during the Tier 2 CTP can be assessed using the Tier 2 questionnaire. A more extensive Tier 3 experience is available through longer motility fellowships at several US and European institutions, which are typically limited to a few specific domains within NGM.

Following endoscopic training paradigms, certain elements of NGM training involving interpretation of motility studies and function testing lend themselves to counting numbers of studies performed and reaching an arbitrary number.[12] However, the study of learning curves for interpretation of motility studies, for instance, suggests that simple numeric thresholds do not establish competence in identification of all motor disorders,[17,18] even though new analysis paradigms and software tools have made interpretation more accurate and less cumbersome.[19,20] Instead, there are variations in learning patterns between trainees that cannot be overcome by case volume alone.[18] An approach that starts with the definition of quality metrics of appropriate test interpretation,[21] and utilizes training that focuses on observable and measurable

metrics, has a greater chance of providing competency in test interpretation.[5,22] NGM societies are currently exploring their role in training and quality control of performance and interpretation of function tests performed within the NGM realm, both in North America and Europe.

Assessment of competency requires evaluation tools, and consequently, credentialing such that only certified centers with qualified and trained individuals perform and interpret function tests and motility studies. The ANMS has undertaken a thorough review of evaluation of competency and is in the process of developing training and evaluation modules for commonly used motility tests such as high-resolution esophageal and anorectal manometry; the ESNM is interested in engaging with the ANMS in developing a uniform consistent training and evaluation system. It is anticipated that the next generation of gastroenterology trainees will have access to web-based training modules that are based on quality metrics defined by experts, addressing competency and credentialing using validated tools.

6 | CONCLUSION AND FUTURE DIRECTION

Gastroenterology training may be the opportune time when trainees shape their career paths, and availability of appropriate NGM resources and opportunities during this period will ensure broader participation in the NGM field. The NGM curriculum has potential to outline the structure of Tier 1 NGM training during standard gastroenterology training, ensuring that interested trainees are well prepared for Tier 2 experiences. Regular updates of the NGM curriculum will be necessary as scientific knowledge and function testing evolve, and training paradigms change; NGM societies will need to invest in the process of revision and renewal of the concepts described in this document.

Programs such as the CTP have been demonstrated to be successful at the Tier 2 level, despite limitations in duration of rotations. The development of training modules specifically targeted at Tier 2 test interpretation skills, with embedded competency assessment and credentialing components, have potential to enhance the value of Tier 2 NGM training. In particular, NGM societies may need to pick up the mantle of ensuring competency and providing credentialing, not just for the physician wanting to interpret function testing but also potentially for the testing facilities and operators. Collaborative relationships with manufacturers of testing hardware and software can ensure appropriate in-servicing and credentialing at the point of acquisition or purchase of testing equipment.

Increasing availability of Tier 3 training will encourage trainees to enter the NGM field, thereby ensuring career development and sustainability within the field. However, existing training environments, especially those in the US, are suboptimal in providing a comprehensive NGM experience and may provide an unbalanced excess of foregut NGM experience.[23] NGM societies have the responsibility to identify and recognize centers of excellence where high-volume NGM patients are evaluated in a balanced environment, and function testing throughout the gut is performed. Grant funding for longer training modules (6-12 months) within specific NGM domains or organized NGM fellowships have potential to enhance training further at the Tier 3 level. The Tier 3 curriculum outlines some of the expectations of a career NGM expert and could be used as a framework for these enhanced training modules.

The NGM curriculum, therefore, has potential to make NGM training expectations more uniform in North America and Europe and potentially elsewhere in the world. It provides a framework for training expectations at 3 hierarchical tiers and particularly for the assessment and evaluation of competence in interpretation of function studies. Structured training has potential to enhance NGM expertise around the world, thereby providing an improved learning experience for future NGM trainees, and better training for educators involving in training programs. Finally, the establishment of the NGM curriculum allows the NGM societies to define the expected outcome of NGM training to other stakeholders, including accreditation organizations, certification bodies, and the society at large.

ACKNOWLEDGMENTS

This report was commissioned by the ANMS and ESNM. The NGM curriculum presented here has been extensively reviewed and fully endorsed by the American Neurogastroenterology and Motility Society (ANMS), European Society of Neurogastroenterology and Motility (ESNM), Australasian Neurogastroenterology and Motility Association (ANGMA), Asian Neurogastroenterology and Motility Association (ANMA), Sociedad Latinoamericana de Neurogastroenterologia (SLNG) and American Society for Gastrointestinal Endoscopy (ASGE).

DISCLOSURES

No competing interests exist for any of the authors.

AUTHOR CONTRIBUTIONS

All authors contributed equally to the intellectual content of the curriculum and this manuscript.

ORCID

C. P. Gyawali http://orcid.org/0000-0002-3388-0660

A. Patel http://orcid.org/0000-0001-7214-5901

S. Roman http://orcid.org/0000-0002-7798-7638

REFERENCES

1. Iobst WF, Caverzagie KJ. Milestones and competency-based medical education. *Gastroenterology*. 2013;145:921-924.
2. D'Amato M. Genes and functional GI disorders: from casual to causal relationship. *Neurogastroenterol Motil*. 2013;25:638-649.

3. Vasant DH, Sharma A, Bhagatwala J, et al. Apprenticeship-based training in neurogastroenterology and motility. *Expert Rev Gastroenterol Hepatol*. 2018;12:215-222.
4. Vasant DH, Radhakrishnan NV. Competency based medical education in gastrointestinal motility-the UK perspective. *Neurogastroenterol Motil*. 2017;29:e12927.
5. Yadlapati R, Keswani RN, Pandolfino JE. Competency based medical education in gastrointestinal motility. *Neurogastroenterol Motil*. 2016;28:1460-1464.
6. American Association for the Study of Liver D, American College of G, American Gastroenterological Association I, et al. The Gastroenterology Core Curriculum, Third Edition. *Gastroenterology*. 2007;132:2012-2018.
7. Oversight Working N, Rose S, Fix OK, et al. Entrustable professional activities for gastroenterology fellowship training. *Gastrointest Endosc*. 2014;80:16-27.
8. Del Valle J. Mentoring education and training: lessons from the past 5 years. *Gastroenterology*. 2016;150:1505-1510.
9. Parkman HP. Training in gastrointestinal motility. *Dig Dis*. 2006;24:221-227.
10. Peery AF, Dellon ES, Lund J, et al. Burden of gastrointestinal disease in the United States: 2012 update. *Gastroenterology*. 2012;143:e1-e3.
11. Camilleri M, Dubois D, Coulie B, et al. Prevalence and socioeconomic impact of upper gastrointestinal disorders in the United States: results of the US Upper Gastrointestinal Study. *Clin Gastroenterol Hepatol*. 2005;3:543-552.
12. Rao SS, Parkman HP. Advanced training in neurogastroenterology and gastrointestinal motility. *Gastroenterology*. 2015;148:881-885.
13. Leichtner AM, Gillis LA, Gupta S, et al. NASPGHAN guidelines for training in pediatric gastroenterology. *J Pediatr Gastroenterol Nutr*. 2013;56(Suppl 1):S1-S8.
14. Chang L. Review article: epidemiology and quality of life in functional gastrointestinal disorders. *Aliment Pharmacol Ther*. 2004;20(Suppl 7):31-39.
15. Drossman DA, Toner BB, Whitehead WE, et al. Cognitive-behavioral therapy versus education and desipramine versus placebo for moderate to severe functional bowel disorders. *Gastroenterology*. 2003;125:19-31.
16. Riehl ME, Pandolfino JE, Palsson OS, et al. Feasibility and acceptability of esophageal-directed hypnotherapy for functional heartburn. *Dis Esophagus*. 2015;29:490-496.
17. Gaddam S, Reddy CA, Munigala S, et al. The learning curve for interpretation of oesophageal high-resolution manometry: a prospective interventional cohort study. *Aliment Pharmacol Ther*. 2017;45:291-299.
18. Yadlapati R, Keswani RN, Ciolino JD, et al. A system to assess the competency for interpretation of esophageal manometry identifies variation in learning curves. *Clin Gastroenterol Hepatol*. 2017;15:e3.
19. Carlson DA, Ravi K, Kahrilas PJ, et al. Diagnosis of esophageal motility disorders: esophageal pressure topography vs conventional line tracing. *Am J Gastroenterol*. 2015;110:967-977.
20. Soudagar AS, Sayuk GS, Gyawali CP. Learners favour high resolution oesophageal manometry with better diagnostic accuracy over conventional line tracings. *Gut*. 2012;61:798-803.
21. Yadlapati R, Gawron AJ, Keswani RN, et al. Identification of quality measures for performance of and interpretation of data from esophageal manometry. *Clin Gastroenterol Hepatol*. 2016;14:e1.
22. Northup PG, Argo CK, Muir AJ, et al. Procedural competency of gastroenterology trainees: from apprenticeship to milestones. *Gastroenterology*. 2013;144:677-680.
23. Sharma A. Training in neurogastroenterology and GI motility in USA: preliminary results of a survey of gastroenterology fellowship program directors. *Gastroenterology*. 2016;150:S201.

How to cite this article: Gyawali CP, Savarino E, Lazarescu A, et al. Curriculum for neurogastroenterology and motility training: A report from the joint ANMS-ESNM task force. *Neurogastroenterol Motil*. 2018;30:e13341. https://doi.org/10.1111/nmo.13341