

NASPGN Guidelines for Training in Pediatric Gastroenterology

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Pediatric gastroenterology is now an established pediatric subspecialty in medical centers across North America. The discipline was initially devoted to cataloging the various disorders that affect the gastrointestinal tract and liver in pediatric patients. It now comprises an extensive knowledge of pathophysiology, numerous diagnostic options, and therapeutic interventions that contribute to the clinical care of infants, children, and adolescents (pediatric patients) with gastrointestinal and nutritionally based disease. Acquisition of specific skills and knowledge is essential for the subspecialist to practice pediatric gastroenterology. Recently, the emergence of this specialty was recognized by the American Board of Pediatrics as a pediatric subspecialty requiring completion of a 3-year fellowship and successful passage

of a sub-Board examination in Pediatric gastroenterology to be certified as a subspecialist. The Royal College of Physicians and Surgeons of Canada recognizes this pediatric subspecialty similarly.

Historically, individual training directors determined the structure of their respective training programs, including the body of knowledge and technical skills required for graduation. Not surprisingly, graduation requirements vary greatly at present. It is the purpose of this document to define the core body of knowledge and technical skills that must be acquired by all pediatric gastroenterology trainees to assure that the care of pediatric patients with gastrointestinal and liver disorders is of the highest quality. The investment in training experts in pediatric gastroenterology and the special skills required to practice pediatric gastroenterology will be under increasing scrutiny as economic issues drive decisions in patient care and as practitioners with insufficient training compete to care for pediatric patients. Accessibility to competent pediatric gastroenterologists is essential in the current economic and managed medical care environment. Therefore, the Executive Council of the North American Society for Pediatric Gastroenterology and Nutrition has established this Core Curriculum in Pediatric Gastroenterology and Nutrition to define the skills and knowledge required of a pediatric gastroenterologist and to differentiate this training from that defined by the Gastroenterology Leadership Council for training in adult gastroenterology (1).

This core curriculum may be of benefit to the Accreditation Council for Graduate Medical Education, which certifies training programs, and to directors of training programs who are accountable for the quality of trainees and their performances. Although the minimum skills and knowledge required to diagnose and manage gastrointestinal and nutritional disorders affecting pediatric patients are defined, individual programs vary according to differences in the career goals of trainees. Three years of training are mandated, but a longer period may be required to acquire skills and knowledge in areas of specialization such as liver transplantation, certain endoscopic techniques, motility disorders, pancreatic diseases, nutrition, and hypothesis-based research.

The NASPGN Training and Education Committee

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provided oversight for development of the Core Curriculum in Pediatric Gastroenterology and Nutrition. The discipline was divided into 11 areas encompassing the cognitive knowledge and procedural skills required for the practice of the subspecialty. The categories include disease-oriented content, gastrointestinal procedures, nutrition, research, and adult gastroenterology. For each category, a recognized expert was enlisted to chair a working group to achieve consensus on the essential cognitive knowledge and procedural skills to be achieved during training. Each group provided recommendations about the process of training, including the role of inpatient and outpatient care, teaching rounds, and conferences. Each section was submitted to the Training and Education Committee and then to expert pediatric reviewers for comment. The research training section was also submitted to the NASPGN Research Committee for review and approval. A revised version of the entire document was submitted by the Training and Education Committee to the NASPGN Executive Council for approval. The Executive Council reviewed the document in detail and resolved controversial issues identified during the review process. This process assured that the final document represents a balanced and reasonable consensus among subspecialists throughout North America and defines the skills and knowledge that should have been acquired by all trainees on completion of their training programs.

The NASPGN Executive Council and the experts enlisted to prepare this document believe that this core curriculum will evolve to meet the changing needs of patients and to incorporate new concepts and technologies. Many intangibles make an outstanding training program. This document represents an attempt by experts in pediatric gastroenterology to define the minimum knowledge and skills expected of a pediatric gastroenterologist and will be a valuable resource to guide future training in pediatric gastroenterology, hepatology, pancreatology, and nutrition.

OVERVIEW OF TRAINING IN PEDIATRIC GASTROENTEROLOGY AND NUTRITION

A pediatric gastroenterologist must possess broad-based knowledge of acute and chronic diseases of the digestive system (esophagus, stomach, intestines, liver, and pancreas) and nutritional disorders that affect pediatric patients. He or she must be able to think critically and generate a relevant differential diagnosis based on an accurate history and physical examination and must understand the indications and contraindications for diagnostic and therapeutic procedures. She or he must be able to manage the treatment of patients in a competent, cost-effective, and compassionate manner and appreciate the humanistic and ethical aspects of medicine. Such attributes can emanate only from training in programs that provide a firm foundation in pathophysiology and an

abundant exposure to a variety of patients under the supervision of experienced, caring, and thought-provoking clinical teachers. This exposure must be focused sufficiently to allow the trainee to understand the natural history of the disease and the impact of treatment on the patient, the disease process, and growth and development of the patient. Mentors must impart a thoughtful cost-conscious and patient-oriented approach to the use of technology as an extension of the subspecialist's craft. Facilities must be available for the trainee not only to create new knowledge and to improve patient care but also to participate actively in research as a means to develop the inquisitive thought processes demanded of a skilled consultant. Central to these activities must be a dedication to patients and their families as people deserving care delivered in a professional and compassionate manner.

Two levels of competence have been defined for 6 of the 11 areas of knowledge discussed in the sections that follow. Level 1 competence, which encompasses the basic skills required to function independently as a consultant in pediatric gastroenterology, should be required for all trainees in pediatric gastroenterology and nutrition. Level 2 competence is achieved in additional focused training with recognized experts. Level 2 competence has been distinguished from level 1 competence for two reasons. First, we believe that a minimum number of procedures or interactions with patients are critical to the development of skills necessary to manage certain disorders and treat certain patients. Furthermore, the skills defined as level 2 are generally performed in specialized centers with adequate patient volumes to obtain proficiency and to provide training opportunities. For these reasons, achievement of level 2 competence in the relevant area is strongly recommended for the pediatric gastroenterologist who participates in transplantation programs, provides specialized consultation on patients with motility disorders, or performs specialized endoscopic procedures. Second, we believe that responsible and productive conduct in certain areas requires focused specialized training. Therefore, guidelines for level 2 competence in pancreatic diseases, in nutrition management, and in conducting clinical and basic research are defined. With advances in technology and the understanding of particular diseases, the numbers of areas recommended and the types of skills or knowledge recommended for specialized, level 2 competence will increase. Thus, we anticipate that this document will require modifications as the practice of pediatric gastroenterology changes in the 21st century.

GENERAL ASPECTS OF TRAINING

Prerequisites

Required training for entry into a pediatric gastroenterology and nutrition program includes successful

completion of a 3-year residency in pediatrics at an institution accredited by the Accreditation Council for Graduate Medical Education (ACGME), the Royal College of Physicians and Surgeons of Canada (RCPSC), or their equivalent in other countries or regions. Candidates who have not completed a 3-year residency in an ACGME- or RCPSC-accredited institution should consult the American Board of Pediatrics or other appropriate board regarding their eligibility for subspecialty certification.

Training Institutions

Pediatric gastroenterology and nutrition training must take place only in institutions that are accredited for both pediatrics and pediatric gastroenterology and nutrition by the ACGME or RCPSC and are affiliated with established medical schools. As outlined in the *Graduate Medical Education Directory* (2), the director and teaching staff of the program must prepare and comply with written educational goals for the program, and all educational components of the program should be related to these goals. Demonstration of institutional commitment to education must include financial resources to support appropriate compensation for faculty and trainees, adequate and modern facilities, space and equipment, adequate clinical support services provided on a 24-hour basis, peer interaction among specialty and subspecialty trainees, and sponsorship of meaningful biomedical research by the primary training institution. The primary training institution must sponsor a minimum of three accredited subspecialty programs. The program design and/or structure must be approved by the Residency Review Committee or RCPSC as part of the regular review process.

Educational Program

Pediatric gastroenterology and nutrition training programs must provide an intellectual environment suitable for acquiring the knowledge, skills, clinical expertise, attitudes, and values of professionalism that are essential to practice the subspecialty. The program must stress the role of the subspecialist as a consultant and promote the skills necessary to communicate effectively with the referring physician. These objectives can be achieved only when the program leadership, faculty, supporting staff, and administration are fully committed to the educational program and when appropriate resources and facilities are available. Service commitments for the trainees should not compromise the achievement of educational goals and objectives.

Training in pediatric gastroenterology and nutrition should cultivate an attitude of inquiry and impart a dedication to continuing education that will remain with the trainees throughout their professional careers. To de-

velop a scholarly attitude, the trainee must actively participate in research projects. This experience should begin in the first year and continue for the entire period of training to allow adequate time to develop research skills and to complete a project. Trainees must help design, conduct, evaluate, and prepare a clinical or basic research project for publication in the subspecialty area.

Duration and Scope of Training

Duration

At least 3 years of supervised progressive educational experience that includes development of procedural skills, responsibility for patient care, and participation in research are required.

Breadth of Experience

In accordance with the "Program Requirements for Education in Pediatric Gastroenterology," (3) the program must emphasize the importance of developmental gastrointestinal physiology, nutritional requirements in pediatric patients and young adults, and correlating pathophysiology with clinical disorders in developing competence in the clinical diagnosis and medical treatment of patients. There must be training in the appropriate selection, performance, and evaluation of procedures necessary for morphologic, physiological, immunologic, microbiologic, and psychosocial assessment of gastrointestinal diseases and nutritional disorders.

Trainees must receive education in the use of a variety of diagnostic tests and therapeutic procedures, including imaging techniques such as conventional radiographs (contrast studies), computed tomography, magnetic resonance imaging, ultrasound, radionuclide scanning, tests of digestive function, histologic interpretation of biopsy specimens, and assessment of nutritional status and pancreatic function.

Procedures

Trainees must understand the appropriate indications, risks, and benefits of diagnostic and therapeutic procedures. Each program must have formal mechanisms for monitoring and documenting the trainees' development of skills in the performance of each procedure on a regular basis. Adequate training and the expected level of competence for each procedure are defined in the various guidelines for training in the sections that follow. Each trainee does not necessarily have to attain competence in all these procedures, but it is important that each trainee become familiar with every procedure and understand its application and interpretation. Therefore, an essential aspect of all training programs is to assure that each trainee

is exposed adequately to common procedures, which include:

- Diagnostic and therapeutic upper gastrointestinal endoscopy
- Percutaneous endoscopic gastrostomy tube placement
- Diagnostic and therapeutic flexible sigmoidoscopy
- Diagnostic and therapeutic colonoscopy
- Percutaneous liver biopsy
- Rectal biopsy
- Anorectal manometry
- Esophageal manometry
- Esophageal pH monitoring
- Breath hydrogen analysis
- Establishment and maintenance of parenteral and enteral nutrition

Environment for Training

Because care of the pediatric patient with a gastrointestinal disease or nutritional disorder often involves a multidisciplinary approach, trainees must learn to work effectively with members of other specialties and subspecialties. Trainees should develop skills in the management and leadership of multidisciplinary teams. Instruction and experience in collaborating with primary caregivers, especially in a managed-care setting, is essential. Trainees must maintain their skills in pediatrics and develop appropriate lines of responsibility with pediatric residents and faculty.

PROGRAM FACULTY

Program Director

The training director must be board certified in pediatric gastroenterology and nutrition or possess equivalent qualifications. The director must be committed full time to the training program and related activities and must be based at the primary site of training.

Specialty Consultants

There must be a minimum of three full-time faculty members who are certified or eligible for certification as a subspecialist in pediatric gastroenterology and nutrition by the American Board of Pediatrics, the Royal College of Physicians and Surgeons of Canada, or their equivalent in other countries or regions. In addition to the minimum requirements for pediatric gastroenterology, faculty consultants and collaborative faculty in the following related pediatric disciplines must be readily available to the program: neonatology, hematology and oncology, immunology, genetics, neurology, and infectious diseases, pediatric surgery, pediatric critical care, pediatric anesthesiology, otolaryngology, pediatric pathology, pe-

diatric radiology, and child psychiatry and/or psychology.

Each pediatric gastroenterology faculty member must be actively involved in clinical care, teaching, research and/or administration. Each faculty member should participate in the critical evaluation of the performance, progress, and competence of trainees. Faculty members must serve as appropriate role models by actively participating in the practice of pediatric gastroenterology, their own continuing education, regional and national scientific societies, research activities, and the presentation and publication of scientific studies and scholarly reviews. A nutritionist or registered dietitian with special skills in pediatrics, a social worker, a nurse specialist in pediatric gastroenterology, and a pediatric speech therapist should be available to the program.

FACILITIES AND RESOURCES

The following must be available to the program:

- A sufficient number of new patients and patients in follow-up to ensure adequate experience with inpatients and outpatients. Patients should include neonates, children, and adolescents, preferably derived from a variety of ethnic backgrounds. Faculty supervision must be available for training with both inpatients and outpatients.
- Up-to-date inpatient and ambulatory care facilities for optimal evaluation and care of patients
- Fully equipped and staffed procedure laboratories that include modern diagnostic and therapeutic endoscopic instruments and motility equipment. The staff must be skilled in the care of pediatric patients. The appropriate equipment must be available for patients ranging in age from the neonate to the young adult. The laboratory must be capable of performing or have access to specialized serologic, parasitologic, immunologic, metabolic, and toxicologic tests applicable to gastrointestinal and hepatobiliary disorders.
- Computers for trainees to search and establish data bases and to record results of procedures
- Supporting services, including a full service emergency room, diagnostic and interventional radiology, pathology laboratory, nuclear medicine department, pediatric and neonatal intensive care units, and surgical and oncology services
- A medical library with on-line capabilities for computer-assisted literature searches
- Appropriate facilities and faculty to provide training and support in gastrointestinal or nutritional research

SPECIFIC PROGRAM CONTENT

Patient Care Experience

Every training program must include a core curriculum to be completed by all trainees. This curriculum

should include clinical training in diagnosis and management of treatment in inpatients and outpatients of pediatric gastrointestinal, hepatic, and nutritional disorders, as outlined in each of the relevant sections that follow on training in pediatric gastroenterology. There must be exposure to both acute and chronic conditions. During this time, an adequate number of routine endoscopic procedures must be performed to exceed the minimum standards prescribed in Training in Endoscopy. Trainees must have appropriate supervised experience in providing consultative services and communicating with physicians and other members of the health-care profession. In recognition of the importance of outpatient medicine to the practice of pediatric gastroenterology and nutrition, all trainees must spend at least one half day per week for the entire 3-year period in an ambulatory care clinic in which both new and continuing care patients are seen.

Training Through Conferences and Other Nonpatient Care Activities

In addition to experience in patient care, trainees should have extensive involvement in other educational experiences. Through a series of lectures, courses, workshops, and seminars, the program should provide instruction in the fundamental disciplines related to the digestive system, including embryology, physiology, pharmacology, nutrition, pathology, biochemistry, molecular biology, immunology, and genetics. There should be training in the evaluation of the psychosocial aspects of chronic gastrointestinal disease and in competent counseling of chronically ill patients and their families. Trainees should be encouraged to develop independent learning skills through reading textbooks and relevant scientific journals and attending seminars, postgraduate courses, and annual scientific meetings of the major digestive disease societies.

Trainees should be actively involved in the planning and conduct of a weekly clinical conference. Basic science, journal club, and research conferences should be held at least monthly. Journal clubs should be used to educate the trainee in the skills of critical reading, detection of biases, application of statistics, validity of conclusions, and related attributes of scientific studies. Interdisciplinary conferences with staff in pediatric radiology, pediatric pathology, and pediatric surgery should be held at least monthly. Participation in quality assurance and continual improvement programs is desirable, as is exposure to formal discussions of medical ethics in didactic lectures and with consultants regarding specific patient treatment issues. The opportunity to learn the essentials of study design, statistics, epidemiology, hypothesis-testing, decision and outcomes analysis, and other skills necessary to conduct clinical investigation should be available to all trainees.

Teaching Experience

Trainees must participate actively in the teaching of medical students, residents, and less advanced trainees in the pediatric gastroenterology and nutrition program. Ample opportunity must be provided for trainees to participate in seminars and conferences to gain experience in presenting and defending concepts in an open forum.

Research Experience

A major component of the trainee's experience should include training in research as defined in the section devoted to that subject.

EVALUATION OF TRAINEE COMPETENCE

Formal procedures for evaluation and feedback are required by the ACGME and RCPSG and are necessary for objective documentation for purposes of credentialing. Training programs must have an established committee to evaluate trainee competence and produce written records detailing the progress of each trainee. These issues should be discussed with each trainee on a regular basis.

Elements of Competence to be Evaluated

Trainees should demonstrate the following:

- An understanding of and commitment to the respectful treatment of patients, their families, and professional colleagues
- A thorough knowledge of history taking, including basic pediatric, family, genetic, psychosocial, and environmental histories and the ability to perform a comprehensive and accurate physical examination
- The ability to arrive at an appropriate differential diagnosis, develop a relevant plan for targeted investigation, and formulate a plan for age-appropriate and cost-effective management of treatment and follow-up of the patient
- The ability to present effectively the results of a consultation orally and verbally and to defend a differential diagnosis and treatment management plan
- A core fund of knowledge in gastrointestinal development, physiology, pathophysiology, molecular biology, genetics, immunology, biochemistry, nutrition, and clinical pharmacology, as outlined in the guidelines in each section
- Appropriate procedural skills as outlined in training in pediatric gastrointestinal endoscopy
- Appropriate research skills and accomplishments as outlined in training in research

Methods of Evaluating Trainees

The following methods should be used to evaluate the trainee's competence:

- Observation during procedures, rounds, and conferences
- Formal evaluation forms from each faculty member who comes into contact with the trainee
- Formal in-service examination to test the knowledge base of the trainee
- Formal assessment of clinical skills using a patient-based examination
- Logbooks or databases and competency evaluations for all endoscopic procedures
- Formal assessment of research progress and accomplishments as outlined in the training in research guidelines

TRAINING IN GASTROINTESTINAL MOTILITY AND FUNCTIONAL DISORDERS

Importance

Functional bowel disorders and gastrointestinal motility disorders account for nearly 40% of patients referred to pediatric gastroenterology consulting physicians. Functional bowel disorders commonly include feeding disorders, chronic complaints of abdominal pain, and defecation disorders. Gastrointestinal motility disorders include abnormalities of oropharyngeal coordination, esophageal peristalsis, gastrointestinal transit, and defecation. Gastroesophageal reflux disease is a special subclass that is considered in the separate section about acid-peptic disorders.

Treatment of patients with functional bowel or gastrointestinal motility disorders requires an understanding of the physiology of gastrointestinal transit and an appreciation of the interactions between the brain and gut. The fully trained pediatric gastroenterologist should understand the indications, utilities, limitations, and judicious use of the tests designed to evaluate the sensory and motor integrity of the gastrointestinal tract. The pediatric gastroenterologist should also understand the importance of psychological aspects of functional disorders and the interdisciplinary approach necessary to treat patients with these disorders.

Guidelines representing the minimum amount of training recommended for all trainees (Level 1, Basic Training) and the specialized motility expert (Level 2, Advanced Training) are described. Level 1 training is expected of all trainees. To achieve level 1 competence, the trainee must understand the pathophysiology of functional bowel and gastrointestinal motility disorders, treat an adequate number of patients with these disorders under the tutelage of experienced mentors, and understand

the rationale, usefulness, and limitations of common motility tests. This training should be completed during the traditional 3-year fellowship. Level 2 training is recommended for a clinician who plans to perform specialized studies of gastrointestinal motility or act as a consultant to other physicians, including pediatric gastroenterologists, regarding the evaluation and treatment of children with uncommon gastrointestinal motility disorders or complex functional disorders. To achieve level 2 competence, the trainee should be trained appropriately in each of the tests he or she conducts and should be familiar with the indications and limitations of all tests that may be useful in management of treatment in this patient population. Expertise in all motility studies is not required. Level 2 training is more intensely focused than level 1 training and may be completed after a 3-year fellowship in pediatric gastroenterology at a site different from the home institution, if necessary.

Goals of Training

Level 1: Basic Training for All Trainees

Trainees should understand the normal process of gastrointestinal transit from the mouth to the anus, which involves understanding the development and maturation of normal physiologic functions including suck and swallow, esophageal transit, gastric emptying, small bowel and colonic transit, and defecation. They should understand the pathophysiology of common disorders of gastrointestinal transit and should be able to apply this understanding to the evaluation of pediatric patients with feeding disorders, dysphasia, vomiting, diarrhea, abdominal distension, constipation, and fecal incontinence. In addition, trainees should demonstrate competence in managing disorders of gastrointestinal motility or defecatory function associated with specific congenital malformations including tracheoesophageal fistula, malrotation, Hirschsprung disease, imperforate anus, and myelomeningocele. They should identify and manage competently disorders of gastrointestinal motility and defecatory function that occur after antireflux surgery, duodenal atresia repair, and colectomy and ileoanal pull-through procedures.

Trainees should attain a thorough understanding of the brain-gut axis and functional bowel disorders including recurrent abdominal pain, irritable bowel disease, and more severe visceral pain syndromes. They should be able to diagnose functional disorders based on a history and medical and psychological information and be able to design an appropriate course of investigation. They should be aware of health-care-seeking behavior and the psychosocial factors that appear to be important in patients with functional bowel disease.

Trainees should acquire an intellectual understanding of the value and limitations of tests used frequently to

diagnose and manage gastrointestinal transit disorders, to know when the tests are valuable in the treatment of patients. These tests include: videofluoroscopic studies of swallowing, esophageal manometry, radionuclide gastric emptying studies, antroduodenal motility studies, radiopaque marker colonic transit studies, anorectal manometry, and anorectal biofeedback. Trainees should recognize the manometric features of major motor disorders of the esophagus and anal sphincter and the indications, dosage, and side effects of medications used commonly to treat motility disorders. All trainees should become competent in performing rectal biopsies adequate for the diagnosis of Hirschsprung disease and in performing esophageal pH probe tests and interpreting the results.

Level 2: Advanced Training for the Expert in Motility and Functional Bowel Disorders

The goal of this level of training is to provide specialized instruction for subspecialty trainees who will conduct and interpret motility studies independently or who plan to participate in the treatment of patients with complicated functional disorders. Those who complete level 2 training will serve as consultants to other gastroenterologists and clinicians. Major therapeutic decisions regarding surgical procedures, routes of appropriate nutritional alimentation, and the use of long-term pharmacologic therapies may rest on the results of the diagnostic studies and evaluations they perform. Therefore, those who want to provide these consultative services should be completely familiar with the logistics of performing and interpreting all the tests described for level 1 trainees.

When the less commonly performed tests or experimental approaches used to evaluate children with gastrointestinal transit disorders or functional disorders are not available at the home institution, the trainee should seek specialized training at an appropriate site. Examples of this type of test include fiberoendoscopic swallowing studies, small bowel and colonic manometry and transit studies, electrogastrography studies, and barostat studies. Level 2 trainees should be familiar with the limitations of these studies and alternative diagnostic approaches. They should understand the possible technical problems encountered and the nuances of interpreting results of manometric and other tests in various clinical scenarios. Level 2 competence requires a more complete understanding of the physiology and pathophysiology of gastrointestinal motility and visceral sensation than is required of the level 1 trainee.

Training Process

Level 1: Basic Level of Training for All Trainees

Trainees should be provided with an appropriate clinical outpatient experience in which to care for patients

with possible functional gastrointestinal or motility disorders. The opportunity to manage the treatment of patients for periods of months to years is essential to provide the trainee with a longitudinal view of these disorders. Exposure to good treatment management and mentoring by physicians with experience and expertise in the field is an integral part of the training of an effective and compassionate pediatric gastroenterologist. The trainee is expected to gradually acquire skills in obtaining a complete history, selecting and interpreting appropriate diagnostic tests, and developing a treatment plan. These activities should include experience in consulting and collaboration with appropriate health-care providers to coordinate care. An important component of training is the interaction between the trainee and appropriate mentors. The mentors should provide constructive guidance and feedback while the trainee gains knowledge, skills, and independence throughout the duration of the program.

Didactic lectures on the pathophysiology and clinical treatment of children with functional gastrointestinal disorders and common gastrointestinal motility disorders should be available. All trainees should be provided with opportunities to perform rectal biopsies to rule out Hirschsprung disease, with an appropriate mentor providing instruction and guidance. The opportunity for performance of esophageal anorectal motility studies should be made available so that trainees can become familiar with the basic approaches used in the study of gastrointestinal motility.

Level 2: Advanced Training for the Expert in Motility and Functional Bowel Disorders

Competence as a level 2 expert may be acquired in a number of areas. Competence in one aspect of diagnostic evaluation or treatment does not imply competence in all areas, but competence in one area may accelerate acquiring competence in another area. The knowledge required to manage a specific disorder is best acquired by participating in treatment and testing of patients under the preceptorship of a suitable expert. Trainees are expected to spend an extended period in a motility laboratory or other setting in which patients with complex functional or motility disorders of the gastrointestinal tract are actively treated.

Level 2 trainees should understand the indications, utility, and limitations of the procedures listed in Table 1, whether or not they become competent in each one. Level 2 trainees must know the role each study may play in diagnostic or investigational protocols for the treatment of patients with functional gastrointestinal disorders and/or gastrointestinal motility disorders. At the completion of level 2 training, the trainee should be capable of providing expert consultation on a broad range of functional and motility disorders. In this capacity, the

TABLE 1. Achieving competence in procedures used for the evaluation and treatment of children with gastrointestinal functional disorders and/or motility disorders

Study type	Threshold # for competence ^a
Level 1	
Esophageal pH monitoring	20
Rectal biopsy to rule out Hirschsprung disease	10
Level 2	
Pharyngoesophageal motility studies	
Fiber endoscopic study of swallowing	25
Indications, interpretation, and significance of videofluoroscopic swallowing studies	20
Esophageal motility	20
Gastric and small bowel motility studies	
Gastric and small bowel motility studies (perfused catheter or solid state)	25
Electrogastrography	25
Barostat studies	25
Indications, interpretation, and significance of scintigraphic measurement of gastric emptying	20
Colonic and anorectal motility studies	
Anorectal manometric studies	20
Anal sphincter biofeedback training	20
Colonic manometry	25
Colonic transit with use of markers	10
Treatment of achalasia	
Pneumatic balloon dilatation	10
Botulinum toxin injection	5 ^b

^a These recommendations represent that minimum number of studies that a group of experts believe is required to attain competence in performing each procedure independently. Trainees should maintain a documented log of appropriate numbers of the types of studies they conduct and interpret while supervised by an appropriate mentor. Competence in performing rectal biopsy to rule out Hirschsprung disease and pH probe tests is expected of all trainees. Competence in other procedures will vary among trainees depending on training opportunities and areas of interest.

^b Assumes competence in upper endoscopy as outlined in "Training in Endoscopy" section.

trainee should be able to determine whether a particular test may be useful to improve a patient's treatment, whether or not he or she can perform the actual procedure. The amount of time required to acquire the skills necessary to act as a competent consultant for a specific problem varies depending on the level of activity of the training program and the previous experience of the trainee.

Acquiring the skills to perform a specific test procedure competently and reproducibly requires ongoing experience. The minimum number of a particular test procedure a trainee must perform to become competent may be difficult to determine. Clearly, experience in troubleshooting the equipment and in waveform and artifact interpretation decreases the number of repetitions required to master a variety of motility studies. Similarly, each trainee's aptitude for performing and interpreting a test may vary. Despite these limitations, members of the Task Force, each of whom has extensive experience in training persons to become proficient in performing mo-

tility studies and interpreting the results, reached consensus on general guidelines for the minimum number of each diagnostic test that a trainee must perform to attain the cognitive skills required to perform the test. These numbers are listed in Table 1.

In addition, level 2 trainees must become familiar with the appropriate indications, contraindications, conduct, and interpretation of each test procedure they plan to perform. They should be familiar with the effects of various medications on test results, including sedatives, and should understand potential complications and treatments of these complications for each test they perform. All level 2 trainees should achieve competence in conducting esophageal and anorectal motility tests and in interpreting the results. This requires an in-depth knowledge of the physiology and pathophysiology related to the relevant region of the gastrointestinal tract. Therefore, the training process must include not only technical training but also tutelage in associated cognitive skills. This is usually accomplished through individual tutorial interactions between the mentor and trainee and by directed, independent reading.

Assessment of Competence

Level 1 training should be certified by the program director or designated mentor or mentors. Certification should be supported by a formal and regular review of the trainee's knowledge of pathophysiology, interview techniques, skills in treatment of patients with functional bowel disease and gastrointestinal motility disorders, and documentation of the number and quality of rectal biopsy procedures and pH probe tests performed.

Level 2 training should be certified by an appropriate mentor. Certification should be supported by documentation of the number and type of procedures performed and a formal review. Trainees should perform each test in a motility laboratory where appropriate discussion and training in the performance of and interpretation of results of motility tests are available. The trainee should perform the recommended number of each test in the presence of the mentor who will certify competence. The trainee should be observed in independent performance of motility tests and interpretation of results. The mentor is ultimately responsible for certifying competence in a particular procedure and certifying competence to function as a consultant to other physicians.

TRAINING IN ACID-PEPTIC DISEASE

Importance

Acid-peptic disorders are common in pediatric patients. The most common acid-peptic disorder in infancy and childhood is esophagitis secondary to gastroesophageal reflux. Other disorders include gastritis, duodenitis,

and duodenal and gastric ulcer. Acid-peptic disease may be considered in the differential diagnosis of many patients in a pediatric gastroenterology practice, including those with abdominal pain, vomiting, heartburn, feeding disorders, and gastrointestinal bleeding. The ability to diagnose acid-peptic disorders accurately has been improved by the use of endoscopy and biopsy of the upper gastrointestinal tract. Not only can a diagnosis be established reliably using endoscopy and biopsy, but effective therapy can be performed using endoscopy for such disorders as esophageal stricture and bleeding ulcer.

Goals of Training

Trainees are expected to acquire knowledge in the following areas:

- Anatomy, physiology, and development of the esophagus, stomach, and duodenum
- Pathophysiology of acid-peptic diseases in the esophagus, stomach, and duodenum
- Disorders of gastric secretory function, in relation to the hypersecretory and achlorhydric states, mucosal protection, and motility that underlie acid-peptic disease
- The natural history, epidemiology, symptomatic presentations, and complications of acid-peptic disorders in children, including peptic ulcer disease, gastritis, esophagitis, and the extraesophageal complications of gastroesophageal reflux disease
- The association of acid-peptic disease with congenital and metabolic disorders that occur solely in childhood, such as tracheoesophageal fistula, gastrointestinal malrotation, and cystic fibrosis
- The differential diagnosis of the manifestations of acid-peptic disorders and nonorganic problems that mimic the symptoms of acid-peptic disease, including recurrent abdominal pain syndromes, irritable bowel syndrome, bulimia, conversion reactions, and Münchausen syndrome by proxy
- The indications, contraindications, benefits, costs, limitations, and interpretations of diagnostic approaches for acid-peptic disorders in children. These include empirical therapeutic trials; serum gastrin measurement; tests for *Helicobacter pylori*; pH monitoring of the pharynx, esophagus, and stomach; esophageal manometry; laryngoscopy; and bronchoscopy.
- The medical therapeutic options for treatment of acid-peptic diseases in pediatric patients, including appropriate lifestyle modifications and pharmacotherapy dependent on patient age. The pharmacology, efficacy, adverse reactions, interactions, and contraindications of the drugs used, including antacids, anticholinergic agents, H₂-receptor antagonists, proton-pump inhibitors, mucosal protective agents, prostaglandin analogues, prokinetic agents, and antibiotics should be understood. Furthermore, the trainee should become

competent in prescribing appropriate pharmacotherapy in children, which includes understanding the effects of body weight, body surface area, and age on drug dosage.

- The role of surgery in treatment of acid-peptic disease in pediatric patients including the various surgical approaches, risks, benefits, and short-term and long-term complications of surgical therapy

Trainees should be able to do the following:

- Obtain a thorough history and conduct a complete physical examination of a child of any age
- Generate a differential diagnosis, formulate a therapeutic plan, and perform diagnostic and therapeutic upper gastrointestinal endoscopies as delineated in Training in Endoscopy
- Interpret upper gastrointestinal tract histology
- Conduct and interpret results of esophageal pH probe studies
- Interpret abdominal plain radiographs and radiographic contrast studies

Training Process

Trainees should be provided with an appropriate clinical outpatient experience in which to care for patients with acid-peptic disorders. The opportunity to manage the treatment of patients for periods of months to years is essential to provide the trainee with a longitudinal view of these disorders. The trainee will gradually acquire skills including history gathering, selection and interpretation of appropriate diagnostic tests, and subsequent development of a treatment plan. The supervised clinical experience with increasing independent decision making by the trainee and feedback from an experienced mentor constitutes the most important aspect of training in the management of pediatric acid-peptic disorders.

Didactic teaching regarding the pathophysiology and nuances of symptoms and clinical management of acid-peptic disorders in children versus adults should be provided. The trainee must also become competent in performing and interpreting results of all the procedures and diagnostic tests that are used routinely in the evaluation and treatment of patients with acid-peptic disorders. Their knowledge should include the indications, limitations, technical aspects, and complications of the relevant procedures. The direct supervision required and mentoring process are outlined in Training in Gastrointestinal Motility and Functional Disorders and Training in Endoscopy.

Assessment of Competence

Knowledge of the management of acid-peptic disease should be assessed as part of the overall evaluation of the trainee in pediatric gastroenterology during fellowship as

outlined in the Overview of Training in Pediatric Gastroenterology and Nutrition. No specific examination or other instrument of assessment is required for this portion of training.

TRAINING IN SHORT-BOWEL SYNDROME AND CONGENITAL ABNORMALITIES OF THE GASTROINTESTINAL TRACT

Importance

Congenital abnormalities of the gastrointestinal tract are the cause of many abnormalities in intestinal function and produce a significant number of gastrointestinal disorders. They consist of two broad categories: anatomic abnormalities of development, which usually require surgical intervention, and intestinal epithelial abnormalities. Consequently, an understanding of embryology and the development of the gastrointestinal tract from an anatomic and functional standpoint is central to the treatment of these disorders. Short-bowel syndrome may be a serious complication of gastrointestinal abnormality and requires that practitioners have expertise in gastrointestinal physiology and nutrition. All fully trained pediatric gastroenterologists should be able to manage short-bowel syndrome and its various complications.

Goals of Training

A basic knowledge of the embryology and development of the gastrointestinal tract is essential for the pediatric gastroenterologist. Trainees should understand the embryologic origins, normal histology, and vascular supply of the entire gastrointestinal tract. Trainees should have a detailed understanding of several fundamental concepts including the complex process of intestinal rotation and fixation, ontogeny, and location of gastrointestinal absorptive and secretory functions such as active bile salt uptake by the ileum and the intestinal adaptive response to surgical resection. This information is necessary to manage various surgical and mucosal congenital abnormalities of the gastrointestinal tract.

The trainee should understand the preoperative and postoperative management of treatment in patients with anatomical abnormalities including tracheoesophageal fistula; omphalocele; gastroschisis; volvulus; duodenal, jejunal, and ileal atresia; and Hirschsprung disease. The trainee should understand the radiologic manifestations of and surgical options available for these conditions and develop a collaborative relationship with the radiologists, surgeons, and transplantation centers in treating these patients. The trainee should understand how to provide the nutritional and electrolyte requirements of patients with short-bowel syndrome and should also understand the role of both nontransplantation surgical options and

bowel transplantation in the management of short-bowel syndrome.

To treat patients with intestinal epithelial abnormalities, the trainee must have a basic understanding of the cell biology of intestinal epithelial cells, especially the cellular processes controlling absorption and secretion and ontogenic and hormonal influences. Thorough knowledge of developmental aspects of nutrient digestion and absorption is important, as is a keen understanding of the pathophysiology of congenital intestinal epithelial abnormalities such as microvillus atrophy, congenital chloride diarrhea, abetalipoproteinemia, and other abnormalities that alter gastrointestinal absorption. The trainee must understand the symptoms, diagnostic evaluation, and management of these conditions.

Training Process

Trainees should be provided with an appropriate supervised clinical inpatient and outpatient experience in which to care for patients with congenital abnormalities of the gastrointestinal tract. The opportunity to manage the treatment of patients for periods of months to years is essential to provide the trainee with a longitudinal view of these disorders. Consultation with radiologists and surgeons who have experience and expertise with this patient population is an integral part of this training. In an adequate training program, the trainee will gradually acquire skills including history gathering, selection and of appropriate diagnostic tests and interpretation of results, subsequent development of a treatment plan, and management of surgical patients.

Didactic teaching related to the embryology and development, epithelial biology, and absorptive and secretory functions of the gastrointestinal tract should be available and should be supplemented with independent study. The trainee must become competent in performing and interpreting all the procedures and diagnostic tests that are used routinely in the evaluation and treatment of patients with congenital abnormalities of the gastrointestinal tract. This should include the indications, limitations, technical aspects, and complications of related surgical and pharmacologic interventions.

Assessment of Competence

Knowledge of the management of congenital disorders of the gastrointestinal tract and of the procedures used for the evaluation and treatment of congenital abnormalities of the gastrointestinal tract should be assessed as part of the overall evaluation of the trainee in pediatric gastroenterology. No specific examination or other instrument of assessment is required for this portion of training.

TRAINING IN INFLAMMATORY BOWEL DISEASES

Importance

The inflammatory bowel diseases (IBDs) in pediatric patients are complex, multifaceted disorders. The severity of IBD is influenced by the basic nature of the disease and by nutritional, endocrine, and emotional factors. Subclasses of IBD are characterized by distinctions in histologic, serologic, radiologic, and endoscopic features. The complexity of IBD necessitates consideration of factors such as the genetics of IBD, mucosal immunity, exacerbating effects of infectious agents, a large number of extraintestinal manifestations, and a variety of treatment options, including radiologic and endoscopic approaches, nutritional support, pharmaceuticals, and surgery. Management of IBD in children differs from the approach in adult patients, because it is important to maintain normal physical, emotional, and psychological growth. Thus, a broad base of pediatric knowledge combined with the special skills of a well-trained gastroenterologist are essential for optimal treatment of children and adolescents with IBD.

Goals of Training

Trainees should be able to effectively diagnose and treat children and adolescents with IBD. They should become familiar with current concepts regarding the causes and pathogenesis of IBD, including the genetics, mucosal immunity (T-cell activation, cytokines and other inflammatory mediators), and infectious agents that may trigger mucosal responses and stimulate additional inflammatory and immune responses.

In any training program, trainees should experience the broad range of clinical manifestations of IBD and should be particularly familiar with features that are specific to pediatric patients, such as delays in growth and pubertal development. They should be able to identify the broad range of extraintestinal manifestations of IBD: rheumatologic involvement including arthritis, arthralgia and ankylosing spondylitis; mucocutaneous signs such as pyoderma gangrenosum and erythema nodosum; urinary tract abnormalities including calculi, fistulae, and ureteral compression; hepatobiliary involvement with autoimmune hepatitis, primary sclerosing cholangitis and gallstones; vascular and thrombotic complications, including deep vein thrombosis and vasculitis; ophthalmologic involvement with episcleritis, glaucoma, and cataracts; metabolic bone disease; and pancreatitis.

Trainees should be able to diagnose and manage IBD using various diagnostic tests including stool examination for pathogens and α_1 -antitrypsin and blood tests for specific autoantibodies and for monitoring disease activity. They should recognize the histologic, radiologic, and endoscopic features that characterize IBD and how they

are used to classify IBD patients and should be able to discriminate features that are peculiar to IBD. In addition, trainees should be aware of the indications for and precautions to be taken with various diagnostic techniques used in diagnosis and management of IBD and should be able to interpret the results. These include abdominal ultrasound, computed tomography, magnetic resonance imaging, radionuclide scans, and endoscopic examination. Development of a collaborative relationship with radiologists is essential for the careful management of IBD.

Trainees should be competent in the nutritional assessment of patients with IBD. This requires familiarity with the indications and forms of nutritional intervention including total parenteral nutrition and enteral feeding techniques. Trainees should also be capable of selecting pharmacologic therapies appropriate for the type, location, and severity of disease. They should be knowledgeable about the dose range, efficacy, toxicity, and appropriate monitoring of drugs used to treat IBD. In addition, they should understand the risk of cancer in IBD, the role of endoscopy in surveillance, and the significance of dysplasia and should know when to recommend surgery in the presence of these factors.

Trainees should understand the indications, timing, and range of surgical therapeutic options available for the patient with IBD. They should be aware of the expected results, prognosis, risk of relapse, potential complications, and approaches to managing these complications. Trainees should also understand the psychosocial impact of IBD and recognize that eating disorders may develop in these patients. They should be capable of educating patients and families and should be aware of the educational materials that aid in this process.

Training Process

Inflammatory bowel disease is a multifaceted disorder that is managed by a pediatric gastroenterologist in collaboration with pediatric nurses, surgeons, pathologists, mental health providers, social workers, radiologists, and dietitians. An integral part of the training process includes the trainee's observation of a clinician experienced in managing IBD. Trainees should evaluate and treat patients with IBD and become increasingly independent as their skills evolve. They should treat acutely ill patients in hospitals as well as ambulatory patients. The opportunity for longitudinal management of treatment of patients with IBD for several years is important to understand disease progression and the psychological impact of IBD on patients and families. Faculty should supervise trainees when they plan, perform, and interpret the results of diagnostic tests including screening and monitoring studies and invasive procedures.

Reviewing biopsy analyses with a pathologist experienced in diagnosing IBD is considered essential. Clinici-

cally oriented conferences during which the pathologic features of the disease are discussed is strongly encouraged. Familiarity with the broad range of radiologic findings in patients with IBD should be obtained during frequent discussions of diagnostic test results with radiologists and gastroenterology faculty in clinical settings. Scheduled conferences in which radiology is a part of the presentation are beneficial.

Involvement of the trainee with a pediatric dietitian or nutritionist should be an integral part of the training program. An approach to dietary and nutritional assessment including anthropometry must be provided.

Knowledge regarding the role of surgery in IBD should be acquired by treating patients and in clinical conferences. Combined medical-surgical conferences can be particularly helpful in this training process. Trainees should be encouraged to gain firsthand experience by observing surgical procedures in the operating room.

Current concepts regarding the pathogenesis of IBD should be acquired through independent reading and discussion of pertinent issues with faculty. The training program should provide relevant material in didactic research and clinical conferences.

Assessment of Competence

The ability of the trainee to treat pediatric patients with IBD should be evaluated through direct observation and supervision by gastroenterology faculty. Trainees should be expected to derive diagnostic assessments and interpret laboratory, endoscopic, histologic, and radiologic findings, and they should be familiar with a broad range of therapeutic options. The mentoring faculty should determine that the trainee's choices of therapy are appropriate. The trainee's knowledge should be assessed as part of the overall evaluation in pediatric gastroenterology. No specific examination or other instrument of assessment is required for this portion of training.

TRAINING IN INFECTIOUS AND IMMUNOLOGIC DISEASES OF THE GASTROINTESTINAL TRACT

Importance

Immunologic and infectious disorders represent important subsets of gastrointestinal diseases to which the pediatric patient is particularly predisposed. Maturation and genetic factors play an important role in the occurrence of these disorders during infancy and early childhood. The varied nature of clinical features, the need for specialized diagnostic testing, and the implications of correct diagnosis and management in maintaining normal growth and development require the specialized skills and experience of a pediatric gastroenterologist.

Goals of Training

Immunologic Disorders Other Than Inflammatory Bowel Disease

The trainee should understand the diagnostic features and the main factors in differential diagnosis distinguishing these disorders from other disorders with symptoms of vomiting, diarrhea, and rectal bleeding. The age-related occurrence of these disorders and other conditions should be recognized in the differential diagnosis. The value and cost-effectiveness of diagnostic testing, including endoscopy, should be understood along with the ability to interpret and use information obtained from mucosal biopsies. The importance of collaborative relationships with physicians with expertise in pathology, radiology, clinical immunology, clinical allergy, and rheumatology should develop from the direct experience of working with these consultants.

Trainees should:

- Be able to effectively diagnose and treat immunologic disorders of the pediatric gastrointestinal tract. To do so, the trainee must acquire an understanding of developmental changes in mucosal barrier function that may predispose to an immunologic reaction, such as changes in permeability or receptor expression.
- Be familiar with the normal functions and compartments of the mucosal immune system and how these functions are altered during immunologic and immunodeficiency disorders
- Understand the epidemiology, varied clinical features, and extraintestinal manifestations of celiac disease (gluten-sensitive enteropathy). This expertise should include the use of noninvasive and invasive diagnostic tests, dietary management, long-term follow-up, and management of complications.
- Be familiar with the epidemiology and clinical features of protein-induced gastrointestinal inflammation of the upper and lower gastrointestinal tracts. This expertise should include the use of oral challenge, serologic assays, and endoscopic procedures in diagnosis and the use of appropriate dietary alternatives in management.
- Be familiar with the clinical features, evaluation, and management of the different forms of eosinophilic gastroenteropathy, as well as the gastrointestinal complications of systemic immunodeficiency disorders, other than human immunodeficiency virus, occurring in childhood. This should include humoral deficiencies, cellular deficiencies, mixed humoral and cellular immunodeficiencies, and neutrophil defects. Specific disorders of importance include X-linked hypogammaglobulinemia, common variable immunodeficiency, severe combined immunodeficiency, selective immunoglobulin A deficiency, and chronic granulomatous disease.

- Understand the clinical features, evaluation, and management of autoimmune enteropathies occurring in isolation or as part of a systemic autoimmune disorder such as autoimmune polyglandular syndromes
- Have a basic knowledge of the clinical features and manifestations of gastrointestinal involvement by systemic vasculitic processes. Important examples include Henoch–Schönlein purpura, hemolytic uremic syndrome, Kawasaki disease, and dermatomyositis and mixed connective tissue disease.

Gastrointestinal Infections

In general, the trainee should be familiar with the various enteric pathogens and their treatment. He or she should understand the basic host defense factors against enteric infection and the factors that determine microbial virulence. The conditions that alter susceptibility to infection such as age or achlorhydria should also be recognized. Trainees should understand specific information about each of five infection subclasses.

Viral enteritis:

- Epidemiology and clinical manifestations of the most common viral enteric pathogen, rotavirus
- Other major viruses, such as caliciviruses, enteric adenoviruses, and astroviruses
- Mechanisms of viral enteritis and which regions of the digestive tract are involved in viral infection
- Common treatment (oral rehydration therapy) as well as adjunctive therapies—for example, probiotic agents and oral immunoglobulins
- The rotavirus vaccine (when it is licensed)
- Features of cytomegalovirus colitis, including its diagnosis and treatment

Bacterial enterocolitis:

- Features that distinguish between bacterial colitis and viral enteritis
- Clinical manifestations (including systemic complications), diagnosis, and treatment of bacterial infections that produce diarrhea, including *Salmonella*, *Shigella*, *Campylobacter*, *Yersinia*, *Escherichia coli* O157:H7, *Clostridium difficile*, *Vibrio*, and *Aeromonas* infections
- The rationale for the use and avoidance of antibiotics in the treatment of specific infections
- Conditions associated with an increased risk of disseminated salmonellosis
- Risk factors for acquiring these infections, including environmental, nosocomial, and zoonotic sources
- Public health issues relating to food-borne infections from these organisms
- Infectious causes of ileitis that may mimic Crohn disease

Parasitic infections:

- Common parasitic infections including giardiasis and cryptosporidiosis
- Clinical manifestations, diagnostic methods, and treatment options for these infections
- Special circumstances of *Cryptosporidium* infection in immunocompromised patients
- Colitis produced by *E. histolytica* and how it is diagnosed and treated

Nonantimicrobial therapy for diarrheal disease:

- Physiologic rationale for and composition of oral rehydration therapy, as well as the cellular mediators of intestinal absorption and secretion (Na^+ , K^+ -ATPases, apical transporters, and chloride channels)
- Risks and benefits of agents that alter intestinal motility and secretion and that adsorb water
- Use of, timing of, and need for refeeding after uncomplicated acute diarrhea
- Nutritional management of chronic diarrhea

Acquired immune deficiency syndrome:

- Gastrointestinal manifestations of acquired immune deficiency syndrome and the enteric pathogens encountered in patients with human immunodeficiency virus

Training Process

Attaining the information described above should be a goal of the training process of all trainees in pediatric gastroenterology and nutrition. Because some of the immunologic disorders described are relatively uncommon, training programs should be based in departments in which a full range of pediatric subspecialists manage the treatment of a large population of referred patients.

A basic understanding of the pathophysiology of these disorders must be attained primarily through didactic and other teaching sessions and independent reading. These topics should be included in the core curriculum. During the 3 years of training, the trainee should understand issues associated with the long-term management of some of these disorders, including problems encountered in dietary management of celiac disease and anti-inflammatory therapies in patients with autoimmune disease. The trainee should be supervised in the management of these disorders by experienced pediatric gastroenterology faculty physicians and gain increased autonomy through the course of their training experience.

Assessment of Competence

The training director should certify basic and clinical competence in the management of gastrointestinal infections and immunologic disorders of the gastrointestinal tract. The knowledge and competence of each trainee

should be assessed by the program director or designee as a result of direct observation of the trainee during ward rounds and outpatient clinics and while giving didactic presentations. No specific examination or other instrument of assessment is required for this portion of training.

TRAINING IN PANCREATIC DISEASE

Importance

Pancreatic disorders are uncommon in children and are a challenge for the pediatric gastroenterologist. Pancreatic disorders are complex diseases that are diagnosed using a wide assortment of methods and are managed differently in various treatment centers. The clinical manifestations and the impact of pancreatic disorders on digestive, nutritional, and growth functions are highly dependent on the developmental stage so that a thorough knowledge of general pediatrics is required to manage treatment in this patient population. Treatment options include nutritional and pharmacologic therapies, radiologic and endoscopic assessments, and endoscopic and surgical interventions. Therefore, a broad base of knowledge is required for the fully trained pediatric gastroenterologist, who is commonly the primary consultant or direct caregiver for these patients, to manage pancreatic disease.

Two levels of training are recommended. Level 1 trainees should understand how to diagnose pancreatic disease in most patients. Level 2 trainees should achieve competence in performing diagnostic and therapeutic procedures that are essential for evaluating and managing complex pancreatic diseases.

Goals of Training

The overall objective of training in pancreatic disorders is to prepare trainees for the evaluation, diagnostic strategy, and treatment of routine and unusual causes of acute and chronic pancreatic disorders in pediatric patients. Trainees should understand the impact of such illnesses on the child and the family. An absolute prerequisite for this training is the demonstration of excellence in knowledge and appropriate clinical and cognitive skills in general pediatrics, so that the unique developmental characteristics and responses to illnesses at different ages and developmental stages can be incorporated into the evaluation and treatment process. In addition, a thorough understanding of the age-related differences in physiology, drug metabolism, and nutritional requirements is necessary to manage these disorders effectively. All training programs must provide trainees with formal teaching in the normal and abnormal physiology of the pancreas and the age-related changes in pancreatic function, physiology, structure, and secretion.

All trainees must attain a thorough understanding of the age-related differential diagnosis and management methods for the pediatric occurrence of pancreatic disorders and must have a basic understanding of the surgical and radiologic therapies available for pediatric patients. The training program must prepare all trainees to understand the basic embryology, physiology, and pathophysiology of the pancreas in the developing infant and child, to acquire a thorough understanding of the diagnosis and treatment of pediatric pancreatic diseases, and to develop competent judgmental skills for the treatment of these patients.

Because pancreatic disease is relatively uncommon in children, it is unlikely that many pediatric gastroenterologists will obtain level 2 training in the management of pancreatic disease. Therefore, it is important that all pediatric trainees be able to collaborate with colleagues in adult gastroenterology who can contribute the specialized knowledge and technical skills required for the treatment of some children with pancreatic disease. Level 2 training requires the mastery of skills in the performance of diagnostic and therapeutic endoscopic retrograde cholangiopancreatography (ERCP; see Training in Endoscopy) and may also include training in performance of pancreatic function testing.

The core curriculum for all trainees should include the following subjects:

- Embryologic development and anatomy of the pancreas and the pancreatic duct system and their common anomalies
- Regulation of pancreatic growth and differentiation
- Physiological processes, regulation, and pathophysiology of pancreatic exocrine secretion of digestive enzymes, water, and electrolytes
- Regulation of the specific digestive enzymes secreted by the pancreas, their methods of activation, and their roles in the digestive process
- Physiological interactions between the exocrine and endocrine pancreas
- Age-appropriate diagnostic approach and management of patients with:
 - acute pancreatitis including recurrent acute pancreatitis and its complications, such as pancreatic pseudocyst;
 - chronic pancreatitis and its complications;
 - exocrine pancreatic insufficiency including cystic fibrosis, Shwachman–Diamond syndrome, Johanson Blizzard syndrome, Pearson marrow pancreas syndrome, Ivemark syndrome, pancreatic agenesis, pancreatic insufficiency associated with duodenal abnormalities, and postsurgical resection pancreatic insufficiency;
 - anatomic anomalies of the pancreas including annular pancreas and pancreas divisum; and
 - pancreatic tumors and masses.

- Evaluation and management of nutritional complications of pancreatic insufficiency
- Role of radiologic and imaging procedures in the cost-effective, age-appropriate evaluation and management of pediatric pancreatic disorders
- Role of, indications for, and risks of ERCP and the potential therapeutic options available with this method
- Pharmacology, indications, age-appropriate dosages, and side effects of common medications for treatment of pancreatic disorders, including pancreatic enzyme supplements
- The indications, contraindications, interpretation, complications, and utility of diagnostic and therapeutic ERCP
- The indications, interpretation, and utility of pancreatic function testing

Training Process

The overall goal of the training is to provide adequate exposure to patients with pancreatic disease during the course of training to fulfill the core knowledge requirements. The training experience should include experience in both the inpatient and outpatient settings and mentoring by faculty who are experienced pediatric gastroenterologists with clinical expertise in pancreatic disease. A critical aspect of this training experience is the ability to evaluate and treat patients with complex problems longitudinally in an outpatient setting in addition to providing direct and/or consultative care for inpatients. Scholarly activity such as didactic lectures, basic or clinical research, and structured presentations are also essential elements of training and must be provided by the training program. Level 2 training is generally obtained after completion of a pediatric gastroenterology training program. This training may be obtained gradually by collaboration with and mentoring by an experienced adult gastroenterologist with expertise in ERCP or during focused participation in an adult ERCP training program and subsequent mentoring by a pediatric or adult gastroenterologist with experience in ERCP in pediatric patients.

Assessment of Competence

Training should be certified by the program director or designated preceptor who should formally evaluate the trainee's knowledge of pancreatic physiology and pathophysiology and diagnostic and treatment skills in patients with pancreatitis and exocrine pancreatic insufficiency. Competence of level 2 trainees is certified on an individual basis by the program director and an appropriate ERCP training mentor selected by the endoscopy training director.

TRAINING IN HEPATOBILIARY DISORDERS

Importance

The evaluation and care of pediatric patients with acute and chronic liver and biliary tract diseases are important components of the practice of pediatric gastroenterology. The discovery of new viral, genetic, and metabolic causes of liver disease in children, the advent of new diagnostic and therapeutic methods, and the wide acceptance of liver transplantation as a viable therapeutic option mandate expanded training in pediatric hepatology in the pediatric gastroenterology core curriculum. The recognition, anticipation, and management of the complications of chronic liver disease are critical during the period in which children with end-stage liver disease are awaiting liver transplantation. Not all pediatric gastroenterologists participate directly in immediate postoperative management in patients who have undergone liver transplantation. For this reason, two levels of training are recommended. Level 1 trainees should understand the preoperative care and the chronic, long-term care required to manage liver transplantation candidates and recipients. Level 2 trainees are expected to perform as consultants working with the transplantation centers and as specialists responsible for all aspects of care for these patients. The ability for all trainees to collaborate closely with surgeons and other members of a pediatric transplantation team is essential.

Goals of Training

The overall goal of training in pediatric hepatology is to prepare the trainee to evaluate, diagnose, and treat routine and unusual causes of acute and chronic liver and biliary tract disorders in pediatric patients and to understand the impact of such illnesses on the child and family. An absolute prerequisite for this training is the demonstration of excellence in knowledge and appropriate clinical and cognitive skills in general pediatrics so that the unique developmental characteristics and responses to illness at different ages and developmental stages can be incorporated into the evaluation and treatment process. In addition, a thorough understanding of the age-related differences in physiology, drug metabolism, and nutritional requirements is necessary to understand and manage these disorders effectively. The acquisition of this knowledge should be achieved by all fellows completing a 3-year fellowship in pediatric gastroenterology. Additional training may be needed for the trainee to meet the criteria necessary to be a specialist in transplantation, as outlined by the United Network for Organ Sharing (UNOS). These criteria include at least 6 months' participation on an active transplantation service (4).

Level 1: Basic Training for All Trainees

Trainees must acquire a broad knowledge of the normal and abnormal physiology of the liver and biliary

system and the age-related changes in hepatic function, physiology, structure, and biliary secretion. Trainees must attain a thorough understanding of the age-related differential diagnosis and treatments for pediatric hepatobiliary disorders.

The training program must prepare the trainee to:

- Understand the basic embryology, biology, and pathobiology of the liver and biliary system in the developing infant and child, acquire a thorough understanding of the diagnosis and treatment of pediatric hepatobiliary diseases, and develop competent judgmental skills for the treatment of these patients
- Acquire technical and cognitive competence in the performance of diagnostic and therapeutic procedures essential to the evaluation and management of pediatric hepatobiliary disorders and the indications, contraindications, and complications associated with these procedures. These procedures include percutaneous liver biopsy and paracentesis in pediatric patients and sclerosis or band ligation of esophageal varices. In addition, competence in achieving conscious sedation in pediatric patients is a necessary component of the skills needed to perform these procedures. Although technical proficiency in ERCP and in transjugular intrahepatic, portosystemic shunting procedures may not be attained by most trainees, they should be familiar with the indications, contraindications, complications, and utility of these procedures.
- Have a basic understanding of the indications for liver transplantation, be equipped to participate in the appropriate evaluation of the child for transplantation, be familiar with the types of transplantation options available for pediatric patients, and have expertise in the long-term management of the child who has undergone transplantation

The core curriculum for education during training should include the following:

- Normal developmental anatomy, physiology, biochemistry, and biology of the liver from embryogenesis to adolescence
- Age-related differential diagnosis for common initial symptoms of pediatric liver disease (jaundice, cholestasis, hepatomegaly, hepatic mass, splenomegaly and portal hypertension, steatorrhea, failure to thrive, pruritus, fat-soluble vitamin deficiencies, gastrointestinal hemorrhage, and fulminant liver failure), the age-appropriate diagnostic approach, and the clinical management of the following hepatobiliary disorders:
 - neonatal cholestatic disorders including extrahepatic biliary atresia, choledochal cyst, neonatal hepatitis, metabolic liver diseases, paucity of interlobular bile ducts, cystic liver diseases and other cholangiopathies, parenteral nutrition-related cholestasis, perinatal infections (viral, bacterial, protozoan, spirochetal), and hypoxic and ischemic liver injury;
 - metabolic liver diseases including α_1 -antitrypsin deficiency, cystic fibrosis, galactosemia, hereditary fructose intolerance, tyrosinemia, Wilson disease, hemochromatosis, peroxisomal disorders, bile acid synthesis defects, neonatal iron storage disease, fatty acid oxidation defects, glycogen storage diseases, lipid storage diseases, urea cycle defects, progressive intrahepatic cholestasis, and other hereditary forms of cholestasis and Reye syndrome;
 - disorders of bilirubin metabolism including physiologic indirect hyperbilirubinemia, breast milk-associated jaundice, Crigler-Najjar syndrome (types I and II), and Dubin-Johnson and Rotor syndromes;
 - acute and chronic hepatitis caused by viruses (e.g., hepatitis virus types A, B, C, D, and E, non-A-E virus, and herpes viruses), drugs, and toxins. Knowledge of the biology, consequences, treatment and prevention (where such knowledge exists) of both vertically and horizontally transmitted viral hepatitis is required;
 - autoimmune and immune hepatobiliary disorders, including autoimmune hepatitis, primary sclerosing cholangitis, graft-versus-host disease, liver allograft rejection, and liver abnormalities associated with autoimmune disorders;
 - drug- and toxin-related acute and chronic liver disease, including alcohol-related disease in the adolescent;
 - fulminant hepatic failure and hepatic coma and its associated complications, such as cerebral edema, hepatorenal syndrome, and coagulopathy;
 - cirrhosis and its complications, including portal hypertension, esophageal varices, ascites, portosystemic encephalopathy, hepatorenal syndrome, and spontaneous bacterial peritonitis;
 - congenital abnormalities in the structural development of the liver, gallbladder, or bile ducts;
 - gallstone formation and gallbladder diseases in infancy and childhood;
 - hepatobiliary disorders and infections encountered in the immune-deficient or immune-suppressed pediatric patient;
 - hepatic tumors and masses occurring in childhood; perioperative evaluation and treatment of patients with liver dysfunction or known underlying liver disease.
- Indications and preoperative care of patients selected for and awaiting liver transplantation; long-term care after transplantation including the management of complications of transplantation: rejection, biliary stricture, vascular problems, opportunistic infections, growth and development abnormalities and lymphoproliferative disease; the effects of liver transplantation on the child's development and the family unit;

- and alterations in general pediatric care, such as immunization schedules and evaluation of fever in the patient with liver disease
- Evaluation and management of nutritional complications of pediatric hepatobiliary diseases
 - Role of radiologic, nuclear, and other imaging procedures in cost-effective and age-appropriate evaluation and management of pediatric hepatobiliary disorders
 - Pharmacology, indications, age-appropriate dosages, toxicity, and side effects of commonly used medications for treatment of hepatic disorders, including antiviral and immunosuppressive agents
 - Recommended schedules and programs for active and passive immunization of pediatric patients against hepatitis viruses and the impact of underlying liver disease or liver transplantation on these and other immunization schedules
 - Pathologic features including knowledge of the histologic features of childhood liver disorders at both the light and electron microscopic levels

Level 2: Advanced Training for the Expert in Pediatric Hepatology

The goal of this level of training is to provide the trainee with the knowledge, cognitive and technical skills, and experience to act as a hepatology consultant to other pediatric gastroenterologists and to qualify as a specialist in liver transplantation (Liver Transplant Physician), according to UNOS (4). All aspects of level 1 training must be mastered before or during level 2 training. Although all level 1 trainees have a basic understanding of the indications, preoperative and postoperative care, long-term follow-up, and complications of liver transplantation in pediatric patients, the trainee who completes level 2 training receives extensive training and experience in pediatric liver transplantation and will be qualified to assume the role as a Liver Transplant Physician or as a director of a liver transplantation program in a UNOS-approved center. Level 2 training can only be achieved at centers with UNOS-approved liver transplantation programs in pediatric patients, in which an average of at least 10 pediatric liver transplantations are performed per year. Therefore, the trainee may have to seek specialized training at an appropriate site.

Training Process

Level 1: Basic Level of Training for All Trainees

The overall goal of training is to provide adequate exposure to pediatric patients with disorders of the hepatobiliary system and to fulfill the core knowledge requirements. This training should include experience in both inpatient and outpatient settings and include famil-

ilarity with the referral and follow-up of liver transplantation patients.

Competence in the cognitive and physical skills required to perform the procedures commonly needed to care for children with hepatobiliary disease must be attained. These procedures include percutaneous liver biopsy, esophageal endoscopy, and sclerosis or band ligation of esophageal varices. Details regarding the learning, mentoring, and evaluation processes for endoscopic procedures are discussed in Training in Endoscopy.

Competence in performing percutaneous liver biopsy and diagnostic and therapeutic paracentesis requires the trainee to perform a minimum number of these procedures under supervision. The trainee must become familiar with the appropriate indications, contraindications, conduct, and interpretation of each procedure. In addition, the trainee should be familiar with the use of sedatives to perform these procedures and with potential complications and approaches to treatment of complications. Therefore, an essential component of the training process includes not only technical training but also tutelage in associated cognitive skills. This is usually accomplished by individual tutorial interactions between the preceptor and trainee and by providing the trainee with appropriate reference literature. The number of each test which a trainee must perform to achieve competence is not known. Nevertheless, members of the Task Force, each of whom has extensive experience in working with trainees to enable them to become proficient in performing these procedures, reached consensus on general guidelines for the minimum number of each procedure generally required to attain minimal proficiency.

Competence in percutaneous liver biopsy requires that the trainee independently perform at least 20 biopsies, half of which should be performed in infants and children less than 3 years of age. At least five paracenteses should be performed independently to demonstrate competence (Table 2).

Regularly scheduled conferences should include didactic lectures, case discussions, literature reviews, and research topics in the area of hepatobiliary diseases. In addition, conferences in which radiologic and histologic findings are presented and discussed are encouraged. Training in hepatobiliary diseases requires faculty who are pediatric gastroenterologists who have recognized clinical expertise in liver and biliary diseases, have at least limited experience in the care of liver transplanta-

TABLE 2. *Studies used for the evaluation and treatment of children with hepatobiliary disorders*

Study type	Threshold # for competence
Percutaneous liver biopsy	20 ^a
Paracenteses	5

^a At least 10 percutaneous liver biopsies must be performed in infants and children <3 years old.

tion patients, and, ideally, are involved in ongoing productive clinical or basic research related to hepatology.

Level 2: Advanced Training for the Expert in Pediatric Hepatology

Some trainees may seek additional training to allow them to attain specialized competence as a pediatric hepatologist and transplantation hepatologist. Guidelines for training as a transplantation specialist are outlined by UNOS (4). This level of training can only be attained in pediatric gastroenterology training programs associated with an active liver transplantation program. In the United States, the criteria for training pediatric liver transplantation specialists (4) apply to a physician who has completed a 3-year pediatric gastroenterology fellowship program that is approved by the American Board of Pediatrics and is accredited by the pediatric residency review committee. The program must include at least 6 months of clinical care for transplantation patients during or after the 3-year fellowship program. In addition, the following conditions must be met:

- Transplant experience in pediatric patients must be gained at a UNOS-approved center, with a qualified liver transplantation specialist and a qualified liver transplantation surgeon, who performs an average of 10 pediatric liver transplantations per year.
- The trainee must be involved in 10 or more pediatric liver transplantations and must follow up on 20 patients for a minimum of 6 months after transplantation under supervision of the transplantation specialist and surgeon, with direct involvement of the trainee in pre-, peri- and postoperative care of 10 or more pediatric liver transplantation patients.
- The trainee must acquire a current working knowledge of liver transplantation including the management of pediatric patients with end-stage liver disease; the selection of appropriate pediatric recipients for transplantation donor selection, determination of histocompatibility, and tissue typing; immediate postoperative care, including those aspects of treatment that are unique to the pediatric transplant recipient; fluid and electrolyte management; the use of immunosuppressive therapy including knowledge of side effects of drugs and complications of immunosuppression; the effects of transplantation and immunosuppressive agents on growth and development; differential diagnosis of liver dysfunction in the allograft recipient; histologic interpretation of allograft biopsy specimens; interpretation of results of ancillary tests for liver dysfunction; and long-term outpatient management of hypertension, nutritional support, and drug dosage, including antibiotics. After this training, appropriate verification of training letters sent to UNOS by the program director, liver transplantation specialist and surgeon are required for the trainee to be recognized as

a liver transplantation specialist or medical director of a pediatric liver transplantation program.

Assessment of Competence

Evaluation of level 1 training involves direct observation of inpatient and outpatient performance, written evaluations at defined intervals, and documentation of clinical and procedural skills as part of the overall evaluation of the pediatric gastroenterology trainee. Trainees and the training program should keep a formal record of the number of procedures performed, age of the patients, and the ability of the trainee to perform each procedure independently in a safe and effective manner. Competence in performing these procedures should be certified by the training program director and appropriate faculty. Competence as a pediatric gastroenterologist does not necessarily imply competence as a transplantation specialist. Some trainees do not receive adequate transplantation experience as part of the training process.

For level 2 training, the trainee should have the training and skills outlined by UNOS (4) and should be capable of functioning independently as the pediatric hepatologist in a liver transplantation program. Competence should be certified jointly by the program's training director and the medical director of the transplantation program.

TRAINING IN ENDOSCOPY

Importance

Pediatric gastrointestinal endoscopy is a fundamental tool for the diagnosis and management of pediatric patients with gastrointestinal disorders. All pediatric gastroenterologists must have the cognitive and technical expertise to diagnose and treat disorders of the gastrointestinal tract, hepatobiliary system, and pancreas. Two levels of training are recommended. Level 1 trainees should achieve competence in the procedural skills of diagnostic and therapeutic endoscopy in pediatric patients to provide comprehensive care to pediatric patients with gastrointestinal disorders. Level 2 training is recommended for those who plan to perform specialized endoscopic procedures required for care of patients with particularly complex disorders.

Goals of Training

Although it is recognized that, formerly, trainees were trained when routine diagnostic and particularly therapeutic endoscopic procedures were not performed commonly in pediatric patients, current practice of pediatric gastroenterology necessitates such training. Routine pediatric upper and lower endoscopy for diagnostic or

therapeutic purposes (Table 3), including treatment of a bleeding lesion if indicated, requires appropriate pediatric specialty training to achieve the basic and clinical knowledge, judgmental skills, and technical competence that enable safe and effective performance of these procedures in pediatric patients.

Diagnostic competence is defined as the ability to recognize abnormalities and to understand the pathologic features of the lesions that can occur. Therapeutic competence is the ability to recognize whether a therapeutic procedure is indicated in a given patient and the ability to perform that procedure safely and successfully in pediatric patients.

A fully trained pediatric gastroenterologist must be competent in the procedures outlined for the level 1 trainee. Advanced endoscopic procedures should be mastered by level 2 trainees who seek to become experts in

pediatric endoscopy. Competence in some of these procedures requires additional training that is not available in most pediatric training programs.

Training Process

Level 1: Basic Training for All Trainees

Level 1 trainees should demonstrate excellence in general clinical pediatrics, including cognitive and technical skills, and should enable development of excellent skills in conducting pediatric endoscopic procedures. The training program should provide a balanced view of the relation between diagnostic and therapeutic procedures and clinical problem solving.

Expertise in pediatric endoscopic procedures requires technical, diagnostic, and therapeutic competence in routine endoscopic procedures. Trainees should perform endoscopic procedures with a pediatric gastroenterologist and learn the indications for and the technique of performing each procedure, the method of recording the results, and the clinical significance of the findings. Essential components of patient safety during endoscopic procedures must be mastered, including the intravenous administration of medications that produce conscious or deep sedation and the application and interpretation of noninvasive patient monitoring devices. Trainees should be familiar with the care, cleaning, and proper maintenance of endoscopy equipment.

Technical skills for endoscopic procedures must be acquired in a sequential fashion. Proficiency develops as an incremental process through performance of a sufficient number of procedures under direct supervision in a methodical sequence of increasing complexity. After suitable supervision, the trainee should be capable of independently performing routine endoscopic procedures including specific therapeutic maneuvers (e.g., polypectomy, foreign body removal) when indicated (Table 3).

After completion of a training program in pediatric gastroenterology, level 1 trainees should be able to:

- Recommend endoscopic procedures on the basis of personal consultation and consideration of specific indications, contraindications, and diagnostic and therapeutic alternatives
- Counsel the pediatric patient and family on bowel preparation and other supportive methods as indicated
- Select and apply appropriate sedation as indicated
- Identify age- and problem-appropriate endoscopy equipment
- Perform each indicated procedure safely, completely, independently, and expeditiously
- Interpret and describe endoscopic findings accurately
- Integrate endoscopic findings or therapy into the management plan
- Understand the inherent risks of endoscopic procedures and be able to recognize and manage complications

TABLE 3. *Minimum numbers required to achieve competency in endoscopic procedures in pediatric patients*

Study type	Threshold # for competence ^a
Level 1	
Upper endoscopy	
Diagnostic (including biopsy)	100 ^b
Therapeutic upper endoscopy with foreign body removal	5
Lower endoscopy	
Flexible sigmoidoscopy	10 ^c
Colonoscopy (including biopsy)	100 ^d
Therapeutic lower endoscopy with snare polypectomy	20
Level 2	
Upper endoscopy	
Therapeutic upper endoscopy with Sclerotherapy or band ligation of varices or bleeding lesion	15
Percutaneous gastrostomy	10
Esophageal dilation (stricture)	15
Control of nonvariceal bleeding	20
Placement of transpyloric feeding tube	5
Dilatation of pyloric or duodenal stricture	5
Enteroscopy	5
Lower endoscopy	
Therapeutic lower endoscopy with Dilatation of stricture	15
Injection therapy or electrocautery	20
ERCP (with sphincterotomy, dilatation of stricture, stent placement or stone removal)	150

^a These numbers represent threshold numbers of procedures that must be performed before competency can be assessed and are adapted from recommendations of the NASPGN Training and Education Committee, ASGE Task Force on Gastrointestinal Endoscopy and Gastrointestinal Bleeding, ASGE Publication No. 1001, 1986, and Methods of Granting Hospital Privileges to Perform Gastrointestinal Endoscopy, ASGE Publication No. 1012, Revised 1992.

^b At least 50 must be performed in patients >12 years old.

^c Flexible sigmoidoscopy skills are most likely assured if adequate colonoscopy experience has been obtained. However, all trainees must perform at least 10 flexible sigmoidoscopies or colonoscopies in patients less than 2 years old to assure competence in this age group.

^d At least 25 must be performed in patients <12 years old.

- Recognize personal and procedural (including equipment) limits and know when to request assistance
- Clean and maintain endoscopic equipment and be familiar with Joint Commission of American Hospital Organization (JCAHO) standards for quality improvement, infection control, sedation, and monitoring

All trainees should achieve competence in procedures including upper endoscopy (esophagogastroduodenoscopy), endoscopy with foreign body removal, and lower endoscopy with polypectomy before completion of fellowship training. It is desirable that additional experience and training in level 2 procedures be obtained during or after the completion of the fellowship to achieve competence in certain procedures including upper endoscopy with control of variceal and nonvariceal bleeding, stricture dilation, and percutaneous endoscopic gastrostomy. Competence in other level 2 procedures is considered advanced endoscopic training. The minimum number of procedures to be performed by all trainees before competence can be assessed is noted in Table 3. These numbers represent the minimum number of procedures that must be performed before competency can be assessed and supersedes the numbers recommended previously (5).

Level 2: Advanced Training for the Expert in Pediatric Endoscopy

Level 2 trainees are those who seek additional training in specific endoscopic procedures. They will function as consultants to other pediatric gastroenterologists when specialized endoscopic procedures are required in pediatric patients. Trainees may learn, in addition to the procedures outlined for the level 1 trainee, diagnostic and therapeutic ERCP, laparoscopy, esophageal stent placement, endoscopic laser therapy, and endoscopic sonography. Level 2 training is generally obtained after completion of a pediatric gastroenterology training program. This training may be obtained gradually in collaboration and mentoring by an experienced adult gastroenterologist with expertise in the specific procedures or during focused participation in an adult therapeutic endoscopy training program and subsequent mentoring by a pediatric or adult gastroenterologist with experience in performing these procedures in pediatric patients.

The following are considered basic requisites for each training program:

- A program director or designate whose responsibilities include:
 - assuring optimal and satisfactory exposure to clinical care and problem-solving in pediatric patients with gastrointestinal disorders by incorporating appropriate conference schedules into the curriculum

to cover basic information pertaining to endoscopic procedures in pediatric patients;

- ensuring learning-appropriate technical and cognitive skills from competent teachers;
 - incorporating endoscopic teaching materials (e.g., books, atlases, videotapes) into the training program;
 - periodically reviewing and updating training methods and the quality of training in the endoscopy unit; and
 - periodically reviewing the progress of trainees to determine attainment of competence in a specific procedure.
- Modern pediatric inpatient, ambulatory care, clinical laboratory, pathology, and radiology facilities to accomplish the overall educational program
 - Proper training for endoscopic procedures including appropriately trained ancillary personnel (e.g., endoscopy nurses); functioning and well-maintained equipment; adequately furnished preparation, endoscopy, and recovery areas; and age-specific equipment and trained personnel to perform cardiopulmonary resuscitation in pediatric patients
 - Access to services provided by certified specialists in pediatric intensive care, pediatric surgery, pediatric anesthesia, pediatric radiology (including experts in sonography and nuclear medicine studies), pathology (with expertise in pediatric gastrointestinal histology), and subspecialists to provide interactive exposure and teaching in these disciplines. These services must be available as a backup for pediatric patients who experience complications during or after procedures.

Assessment of Competence

Evaluation of trainees involves three phases: direct observation of performance, evaluation to promote improvement and avoid errors, and documentation of clinical and procedural skills. Direct observation and evaluation are the responsibilities of the attending physician at the time of each procedure. Feedback should be immediate and direct, with constructive and informative discussion between attending physician and fellow. The conduct and objective assessment of each procedure should be documented by the attending physician. Ongoing progress should be discussed formally with the training director or designate during a periodic review of the procedures performed and the evaluations of each trainee. These reviews should occur two to four times a year.

Certification of competence requires satisfactory performance in a minimum number of cases of each procedure under direct supervision, with independent performance of procedures demonstrated as indicated by proficiency of the trainee and the clinical setting. Certification also requires proficiency in all aspects of use and

maintenance of endoscopy equipment and in pediatric patient preparation and sedation.

TRAINING IN NUTRITION

Importance

Providing appropriate nutrition to support normal growth and development is a cornerstone of pediatric care. The science of clinical nutrition focuses on the effects of nutrient deficiencies and excesses during acute and chronic illness and the role of diet and specific nutrients in the development of chronic illnesses, such as obesity, type II diabetes, coronary artery disease, and cancer, that appear to have their clinical onset in adulthood. Thus, knowledge of the role of specific nutrients in health and disease, the nutrient requirements of growing infants and children, the ability to assess the nutritional status of pediatric patients, and an understanding of and a familiarity with the techniques of delivering nutrients to these patients are basic goals for all trainees in pediatric gastroenterology and nutrition. In support of these goals, trainees should understand the physiology of nutrient digestion, absorption, metabolism, and elimination and be able to integrate this knowledge into a plan for the nutritional support appropriate for each patient. Some understanding of the epidemiology of nutritional disorders is also important. These goals define the recommended level of training for all trainees (Level 1, Basic Training).

Some trainees may have a particular interest in nutrition and may attain a higher degree of proficiency. Level 2 training (Advanced Training) is recommended for those who plan to direct a nutrition support service or to conduct research directly related to pediatric nutrition.

Goals of Training

Level 1: Basic Training for All Trainees

The core curriculum should provide the trainee with an understanding of the biochemistry, digestion, absorption, and metabolism of macronutrients and micronutrients, including proteins, carbohydrates, lipids, vitamins, minerals, and trace elements. Information about the physiology of starvation and the metabolic and nutritional consequences of physiological stress, along with age-related changes in nutrient metabolism, absorption, and digestion should be provided. Level 1 trainees should understand the theoretical basis for the estimates of energy, protein, carbohydrate, fiber, fat, mineral, trace element, and vitamin requirements of healthy pediatric patients, as well as how these requirements vary with age and health status.

Assessment of nutritional status is the primary step in the recognition and evaluation of pediatric patients

whose growth differs from the norm and should be an integral part of the evaluation and treatment of children with acute and chronic disease. An understanding of the use of a detailed diet history and other methods of assessing nutrient intake is of obvious importance. The trainee should be familiar with the various techniques available for clinical assessment of nutritional status. This includes careful inspection of the patient for generalized and specific signs of nutrient excess or deficiencies (e.g., cheilosis, xerosis, and dermatitis). Anthropometry should be used to assess growth either cross-sectionally or longitudinally, by measurements of length and stature, weight, head circumference, midarm circumference, and triceps skinfold thickness. The trainee should understand the use of these measurements and the indices derived from them, such as body mass index and weight-for-height, in the classification of undernutrition (protein and energy) and obesity. The trainee should understand the importance of nutritional assessment derived from measuring body composition, nitrogen balance, and energy expenditure as well as the use of hematologic and biochemical indices of nutritional status.

In the area of infant nutrition, the trainee should be familiar with the physiology of lactation and support of the breast-feeding mother and should know the composition of human milk and infant formulas and how these foods support the growth of the developing infant. The specific nutritional requirements of the preterm infant and the development of gastrointestinal function in premature and term infants should be understood as well. The trainee should be able to relate an understanding of the different stages in the development of gastrointestinal function to methods of nutritional support. The trainee should understand the approach to feeding problems in infants with particular difficulties such as cleft palate, swallowing dysfunction, and gastroesophageal reflux.

The trainee should recognize failure to thrive in infancy, understand its causes, and be able to treat such patients. In addition, the requirements for micro- and macronutrients and the means of nutritional support should be understood for the following disease states:

- Gastrointestinal, hepatobiliary, and pancreatic diseases characterized by emesis, chronic diarrhea, and maldigestion or malabsorption
- Acute gastroenteritis and oral fluid therapy
- Inflammatory disorders of the gastrointestinal tract

The trainee should understand the principles of nutritional support for patients with:

- Inborn errors of metabolism
- Diabetes mellitus
- Hyperlipidemia or risk for cardiovascular disease
- Obesity or an eating disorder
- Chronic dysfunction of single or multiple organ systems
- Food hypersensitivity

- Acute or chronic infections, such as human immunodeficiency virus or tuberculosis

Trainees should understand the role of nutrition in the prevention of chronic illnesses (including those that may occur later in life), including the relationship between undernutrition and susceptibility to infectious illnesses, the role of nutrition in support of optimal oral health, and the role of diet in lowering the risk of illnesses such as cancer and heart disease. It is also important for trainees to understand the nutritional aspects and risks of vegetarian diets, food fads, and other dietary patterns not practiced by most children and adolescents.

Trainees should be familiar with enteral nutrition support and understand when this therapy is indicated. Such situations include: prematurity; cardiac, renal, hepatobiliary, and pulmonary diseases; acute and chronic gastrointestinal disease or dysfunction; and when absorption and digestion are possible through the use of specifically tailored feeding techniques, specific nutrient formulations, or a combination of the two. They should be familiar with available infusion devices and the techniques of placing feeding tubes (e.g., nasogastric, nasojejunal, jejunal, and percutaneous gastrostomy feeding tubes). They should know the composition of available commercially prepared formulas for infants and children, including standard hospital enteral feeding formulas, elemental formulas, oral supplements, blenderized feedings, and modular components. They should be able to modify enteral feedings to meet the special needs of individual patients and should be cognizant of interactions between drugs and nutrients.

Trainee must be knowledgeable about the indications for parenteral nutrition and the physiology, techniques for administration, and efficacy of parenteral nutrition for pediatric patients with gastrointestinal and other medical problems that preclude or severely limit the use of the intestine for nutrition. Examples of these conditions include prematurity; severe respiratory or cardiac disease; congenital anomalies of the gastrointestinal tract; severe inflammatory disease of the intestinal mucosa; protracted diarrhea; short-bowel syndrome; extensive body-surface burns; malignant disease; and hepatic, cardiac, or renal failure. Trainees should be familiar with parenteral nutrition catheters and the complications arising from their use, as well as the composition and metabolic effects of the solutions used to provide parenteral nutrition. They should also be knowledgeable in monitoring such patients in the hospital and the home and be able to collaborate with a multidisciplinary team and manage nonsurgical complications of parenteral nutrition.

Level 2: Advanced Training for the Expert in Nutrition

At the completion of training, the level 2 trainee should be capable of functioning as the medical director

of a hospital-based nutrition support team. Such trainees should possess:

- An understanding of the organization and administrative requirements of a hospital-based nutrition support team and the ability to collaborate with nurses, pharmacists, and dietitians in the coordination of nutrition support services in the inpatient and outpatient settings
- A detailed understanding of the components of enteral feeding solutions and the ability to participate in the cost-effective selection of an appropriate range of formulas for inclusion in the hospital formulary
- A detailed knowledge of the components used in formulation of parenteral nutrition solutions, including the various amino acids, lipids, vitamins, and minerals.
- An ability to establish institutional guidelines for monitoring and maintaining enteral and parenteral access devices.
- An understanding of the basic principles involved in the use of stable isotopes, neutron activation, photon x-ray absorptiometry, bioelectrical impedance, and total-body electrical conductivity
- A detailed understanding of the specific principles of nutritional support for patients with inborn errors of metabolism or hyperlipidemia or for those who are at risk for cardiovascular disease
- An ability to manage multidisciplinary clinics for children who are obese or have eating or feeding disorders
- An understanding of how the nutrient requirements imposed by pregnancy and lactation influence nutrition in the adolescent to provide nutritional support and counseling to pregnant and lactating adolescents. The trainee should also acquire an understanding of the transfer of ingested substances, including caffeine, drugs, alcohol, medications, and allergens, across the placenta or into breast milk and their effects on the fetus and breast-fed infant.

Training Process

Training in nutrition by knowledgeable faculty who work with the trainee to review nutritional assessment and treat patients is essential. The trainee benefits from exposure to the widest possible variety of nutritional problems that arise in pediatric patients, including acute and chronic illness and illnesses of the gastrointestinal tract (e.g., dysmotility, inflammatory disease, enteropathies, chronic hepatobiliary disease, and chronic pancreatic disease). Didactic lectures and directed readings are useful components of the training program. The trainee should be familiar with and participate in providing nutritional support by both enteral and parenteral techniques to patients in intensive care and to those in the general pediatric units and the neonatal intensive care unit. These experiences in nutritional support can be obtained through service in a ward, a nutrition consultation service, or a clinic devoted to the longitudinal care of the

nutritional needs of patients with recurrent needs. These activities should be accompanied by didactic lectures and directed readings devoted to nutritional issues, including the pathophysiology of malnutrition, current research activity in nutritional issues, and clinical conferences devoted to discussion of specific patient problems.

Level 2 training in pediatric nutrition can be obtained at an institution that has a full-time faculty in nutrition. Such a faculty should be expert in basic science and clinical research and/or in the area of nutrition and public health. The period of advanced training should be for a minimum of 1 year, with longer periods dependent on the progress of research projects. An extended period should be spent caring for the nutritional needs of inpatients and outpatients. Participation as the physician member of a nutrition support team with a faculty mentor's careful observation is a useful part of this process. Because teaching is a particularly important component of the nutrition specialist's responsibilities, level 2 trainees should also be involved in providing level 1 training to fellows in pediatric gastroenterology and should be provided with mentored opportunities to teach nutrition to house staff, medical students, and other health-care professionals.

Assessment of Competence

Level 1 competence in the nutritional support of pediatric patients should be assessed as part of the overall evaluation of the trainee, as outlined in the Overview of Training in Pediatric Gastroenterology and Nutrition.

A level 2 trainee should be capable of functioning independently as the medical director for a hospital-based nutrition support team and/or as an active researcher in pediatric nutrition. There is currently no board-sanctioned certificate for specific competence in pediatric nutrition. Level 2 competence should be certified by a mentor who is an established expert in nutrition support, such as a director of a nutrition support team at a large pediatric center.

TRAINING IN RESEARCH

Importance

The diagnosis, treatment, and prevention of gastrointestinal, hepatic, and nutritional disorders that affect children will continue to improve if the basic mechanisms underlying these disorders can be determined and new, carefully tested treatment strategies continue to be developed. This requires ongoing basic and clinical research endeavors of high quality. Often the most salient and timely discoveries and developments are made by physicians who actively treat affected patients. Thus, a cohort of physician-scientists within the discipline of pediatric gastroenterology and nutrition is needed to pro-

vide a continual source of reliable information about the pathogenesis, diagnosis, treatment, and prevention of the disorders that affect their patients. Two levels of training are recommended. Level 1 training is required of all trainees and provides a basic understanding of the processes involved in posing and testing a hypothesis and in development of an appreciation for scientific inquiry and the scientific literature. Level 2 training is recommended for those who plan to engage in a career in basic or clinical research in an academic setting.

Goals of Training

Level 1: Basic Training for All Trainees

All trainees must meet the requirements for certification in a pediatric subspecialty, as specified by the American Board of Pediatrics. Each trainee must conduct a research project, either basic or clinical, that is hypothesis driven under the direction of a suitable mentor. Training includes participation in identifying a research question, formulating a working hypothesis, designing and performing appropriate experiments, analyzing data using appropriate statistical tests, and presenting the work as the first author of a research paper, submitted manuscript, or research progress report. Case reports and descriptive, retrospective chart reviews do not fulfill this requirement. Trainees should have a critical understanding of the current literature, scientific writing, statistical and power calculations, research ethics, grant preparation, institutional review board requirements, and formal presentation of research results.

Level 2: Advanced Training for Research

Level 2 training is recommended for those planning to become principal investigators or major contributors to a research group and who intend to obtain extramural funding. Trainees can achieve these goals only when their efforts are sustained, focused, and relatively free from nonresearch-related responsibilities. The training program in pediatric gastroenterology outlined in these guidelines describes 3 full years of study. Level 2 expertise in research in gastroenterology can only be achieved with further focused research activity after the completion of a traditional 3-year fellowship.

Trainees should work in a laboratory or clinical setting under the supervision of an appropriate mentor. They should be productive (publish one to three manuscripts per year), present their results annually in major scientific meetings, help train others in the laboratory or clinic, and obtain extramural grant funding. Research should be conducted in a stimulating and intellectually rich environment that can support these activities.

Training Process

The training process for level 1 and level 2 trainees should be essentially identical. However, the level 2 trainee should be encouraged to gain a greater degree of autonomy from the research mentor and should be provided with experience in preparing research grant proposals.

Research Mentor

The research mentor is an extremely important element of the training experience and must have a commitment to and experience in the training of fledgling investigators. The mentor should have an established record of productivity in sponsored research and should have attained excellence in a particular field. She or he may be a faculty member of the pediatric gastroenterology training program or a member of another division or department but must be aware of opportunities for collaborative interaction locally and nationally in the area under investigation by the trainee and must be principally responsible for fostering the development of the trainee into an independent investigator.

Structured Curriculum

The training program should provide the opportunity to participate in formal course work necessary to acquire the basic knowledge and specific skills required to complete the research project competently. Courses may include physiology of the gastrointestinal tract and liver; cellular, molecular or developmental biology; nutrition; epidemiology; biostatistics; outcome analysis; ethics; study design; and scientific writing. Trainees should have the opportunity to attend seminars presented by scientists within the institution as well as by visiting scientists.

Protected Time

The trainee must have sufficient protected time during the training period to complete a research project, to participate in the course work outlined earlier, and to conduct research. The period of protected time required varies depending on the specific career goals of the trainee and the progress of the research project. Successful completion of a research project by all trainees requires a minimum of 18 months, during which 80% of effort is devoted to research. For the trainee who pursues level 2 competency, at least 80% of effort should be devoted to research, even if this training extends beyond the traditional training period.

Research Environment

The training should be conducted in a stimulating and intellectually rich research environment. Faculty of the training program must include persons with established skills in basic or clinical research. Trainees should have the opportunity to discuss and critically analyze current literature, present their work in research conferences, seek information through independent study and under the direction of recognized experts, and seek expert consultation in a wide variety of disciplines.

Assessment of Competence

Level 1 and level 2 trainees should be evaluated formally at least twice a year by the program director, research mentor, or research committee comprising three or four members of the training program faculty or those who work in related areas. Evaluation should include an evaluation of the trainee's participation and progress in a research project and course work, as well as feedback in the form of constructive criticism and, if necessary, suggestions for future research. Objective criteria for evaluation can include the number and quality of abstract presentations, publications, and grant applications. Evaluations should be written and copies made available to the trainee and mentor. If progress is considered to be unsatisfactory, it should be the responsibility of the program director to discuss the issue with the trainee and to propose mechanisms for improvement.

PEDIATRIC TRAINING IN ADULT GASTROENTEROLOGY

Importance

The practicing pediatric gastroenterologist must understand certain aspects of gastroenterology as practiced by internists. This is of specific importance when the care of a patient with chronic gastrointestinal disease since childhood is transferred from a pediatrician to an internist. The pediatric gastroenterologist must be aware of the long-term complications of commonly encountered entities such as inflammatory bowel disease, irritable bowel syndrome, and chronic viral hepatitis, as well as the long-term complications of drugs that are commonly used to treat these disorders, such as corticosteroids and azathioprine. Experience in adult gastroenterology also assures that the trainee has an understanding of those disease processes that occur frequently in the adult population but are rarely encountered in the pediatric population. Examples of these diseases include tumors of the gastrointestinal tract and methods of screening for diseases such as colon cancer, alcohol-induced liver and pancreatic disease, and complications of intravenous drug abuse. Finally, interactions with adult gas-

troenterologists provide the pediatric gastroenterology trainee with an understanding of the available specialized procedures for diagnosis (e.g., endoscopic ultrasound) and treatment (e.g., ERCP with papillotomy and stent placement) that are commonplace in adult gastroenterology practice but rare in pediatric practice. Thus, the pediatric gastroenterologist can collaborate with adult colleagues in caring for children who may benefit from these specialized procedures.

Goals of Training

The pediatric gastroenterology trainee is not expected to become knowledgeable about and proficient in caring for adult patients. Competency in adult gastroenterology requires completion of an adult gastroenterology training program. However, trainees in pediatric gastroenterology should understand the general concepts in adult gastroenterology and be able to do the following:

- Understand the long-term complications of diseases commonly encountered in adult gastroenterology, many of which begin in the childhood and adolescence
- Be aware of the long-term complications of drugs used to treat common gastrointestinal disorders in children and adolescents, because these complications may manifest only in adulthood
- Appreciate the differences between adult and pediatric patients in disease incidence and the diagnostic approaches to specific symptoms (such as gastrointestinal bleeding or fecal incontinence)
- Be familiar with the indications and risks of the specialized diagnostic and therapeutic methods that are used frequently by the adult gastroenterologist but are rarely required for treatment of pediatric patients such as ERCP with papillotomy, endoscopic ultrasound, and other interventional endoscopic techniques

Training Process

Trainees should routinely attend clinical conferences during which adult gastroenterology cases are discussed. Limited experience participating in an adult gastroenterology service may offer further exposure, but close proctoring is required, because the average pediatric gastroenterology trainee does not have the background in internal medicine required to function as an adult gastroenterologist. Participation in adult endoscopic procedures with the mentorship of an experienced adult endoscopist can provide the trainee with valuable experience in various interventional procedures.

The trainee should be proctored by an experienced pediatric gastroenterologist in the process of collaborating with colleagues who treat adults when specialized procedures are performed in children. The skilled pediatric gastroenterologist remains the physician primarily

responsible for the medical and psychological care of the child and family, allowing the adult specialists to focus their activities on those aspects of care specifically related to the procedure.

Assessment of Competence

Knowledge of adult gastroenterology should be assessed as part of the overall evaluation of the trainee in pediatric gastroenterology. Competence should be certified by the program director or the designated preceptor who can formally evaluate the trainee's fund of knowledge. No specific examination or other instrument of assessment is required for this portion of training.

APPENDIX

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