Pediatric Education for Subspecialists

Fredric D. Burg

University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, 19104-6087, USA

A pediatric subspecialist is, in most cases, an individual who has already mastered the skills and abilities of the general pediatrician and who has taken additional educational experiences to learn how to deal with the problems of infants, children, and adolescents in a specialized area of pediatrics. Presently, there are pediatric specialists in the following areas:

- Allergy/immunology
- Hematology
- Nephrology
- Neonatology
- Genetics
- Endocrinology
- Cardiology
- Neurology
- Adolescence

- Critical care pediatrics
- Infectious disease
- Oncology
- Gastroenterology
- Perinatology
- Pulmonology
- Psychiatry
- Rheumatology
- Behavioral/child development

In the industrialized nations of the world, the pediatric subspecialist plays a critical role in the delivery of care to patients in a variety of settings. Many pediatric subspecialists serve as primary care physicians to their patients. They manage the routine problems of the patient and family and, when appropriate, refer to other subspecialists. Because of their special education and the development of skills and abilities in a particular area of pediatrics, they will care for a patient with complex problems in their area of expertise. These patients will have been referred to the subspecialist by other physicians and health care providers. They often will care for these referred cases within the hospital or ambulatory care facility. In many situations, the subspecialist will refer the patient back to the physician who sent the patient for consultation. The patient and family will then be managed in a cooperative fashion between these two health care providers.

Most subspecialists play a major role as medical educators. They often work in universities, medical schools, and large teaching hospitals. They are frequently given the responsibility for educating medical students, residents, pediatricians, and
other general physicians in learning about a subspecialty area, so that when these individuals are confronted with a child with a medical problem in that area, they are capable of managing the problem and deciding if they need the help of the pediatric subspecialist.

The vast majority of research in pediatrics is conducted under the direction of pediatric subspecialists. Most granting agencies prefer to award their funds to individuals who are working on research questions in one of the pediatric subspecialty areas. Also, as will be described later, most pediatric subspecialists spend a significant amount of time during their formal education learning how to conduct research.

Finally, because of their active work in patient care, education, and research, many of the major administrative posts in medical schools and teaching hospitals are assigned to the subspecialist. These posts include department chairman, division chief, dean, associate dean, and director of a research institute. Having such administrative positions often places pediatric subspecialists in positions of great power and authority at the local and national levels.

**PROCESS OF EDUCATION FOR THE PEDIATRIC SUBSPECIALIST**

Over the years, there has been a trend to require that pediatricians who wish to be educated as subspecialists spend at least 3 full years developing their skills and abilities as general pediatricians before they embark on further education to become competent as a subspecialist. In the United States, an individual can only begin a subspecialty fellowship with special approval if he has less than 3 years of general pediatric education.

Having successfully completed 3 years of general pediatric education, the trainee then enters a subspecialty educational program that presently lasts between 2 and 3 years. In the United States, a number of pediatric specialties have nationally accepted definitions of the scope and content of the educational experience. These definitions have been developed by the accrediting body for pediatrics and have been approved by the leading organizations that oversee pediatric education in the United States, namely, the American Academy of Pediatrics, the American Board of Pediatrics, the Association of Pediatric Medical School Department Chairmen, the American Pediatric Society, and the Ambulatory Pediatrics Association. Excerpts from these descriptions follow:

**Pediatric Cardiology**

**Special Requirements for Programs in Pediatric Cardiology (1)**

*Duration of Training and Prerequisites*

A minimum of 2 years* is required, and a third year, emphasizing research prepa-
ratory to an academic career, is strongly recommended. Training need not be con-
fined to the parent institution, although it is essential that the resident in pediatric cardiology receives progressive education, experience, and responsibilities in the specialty.

Training programs in pediatric cardiology must exist in conjunction with an accredited 3-year pediatric residency program; these postgraduate programs should not dilute the patient material available to the core program.

Ordinarily, the resident will have completed 3 years of training in an accredited pediatric residency program prior to beginning a program in pediatric cardiology.

**General Scope of Approved Programs**

Graduate training in pediatric cardiology should provide properly balanced, well-organized, and progressive responsibility for care and study of patients on ward and outpatient services. This must encompass age groups from the newborn (including premature infants) through adolescence. Approved programs must include adequate training in the basic medical sciences, as well as in the clinical laboratory, public health, and community aspects of pediatric cardiology. Significant experience in investigational activities is expected. The resident must be exposed to pathologic conditions ranging from moderate to those found in the seriously ill child needing intensive care. There must be experience with a broad spectrum of congenital and acquired heart disease, both surgical and medical, and chronic as well as acute or emergency situations. There should be opportunities to develop teaching skills. These opportunities should include both formal and informal experiences, including rounds, outpatient clinics, conferences, grand rounds, and formal lectures. There should be opportunities to participate in and learn the fundamentals of administration of a pediatric cardiology program, including organization of clinics, organization and function of the cardiac team, and interaction with support agencies in the community such as Crippled Children’s Services (CCS), insurance companies, school nurses, public health nurses, and others.

**Content Areas**

**Basic sciences**

The program should offer instruction through courses, seminars, workshops, or laboratory experience to provide appropriate background in basic and fundamental disciplines related to the heart and cardiovascular system, such as anatomy, physiology, biochemistry, embryology, pathology, pharmacology, genetics, bioelectronics, and biostatistics. The resident must receive instruction in cardiovascular pathology. Specimens demonstrating the various types of congenital cardiovascular anomalies should be classified and readily available for study. Conferences involving current pathological material must be held and closely correlated with clinical experience; such conferences should include clinicians, surgeons, physiologists, roentgenologists, and pathologists.
Thorough understanding of embryology and anatomy of the normal heart and vascular system as well as the deviations from normal that may occur should be mastered. Normal and abnormal cardiovascular and cardiopulmonary physiology and metabolism should be taught, as well as fundamentals of cardiovascular pharmacology, including mechanisms of drug action, therapeutic indications, and side effects.

Clinical practice

The program should prepare the resident to provide optimal care and consultation for children with cardiovascular disease. Clinical experience should be broad and include inpatient and outpatient experience and encompass age groups from newborn through adolescence (preferably birth to 21 years) with opportunity to observe heart disease in adults, particularly congenital and rheumatic disease.

Aftercare. The resident should participate in consultations or conferences in which the medical and surgical staffs evaluate the results of surgery and the patient’s cardiac status prior to discharge from the hospital. The resident should have the opportunity to arrange for follow-up visits and send information to the referring physician to assist in the future management of the patient.

Residencies in pediatric cardiology must offer broad and inclusive training in the specialty. This should include fundamentals of clinical diagnosis with special emphasis on auscultation and physical examination, roentgenology, electrocardiography, 2-D and M-mode echocardiography, radionuclear cardiology, exercise stress testing, Holter monitoring, and other laboratory tests that may become established to facilitate diagnosis and management. Experience and instruction in techniques and understanding of the limitations of cardiac catheterization and selective angiography are required. Opportunity must be provided for the resident to participate in a minimum number of catheterizations in infants and children; this number may vary from institution to institution, but should equal approximately 100 patients during a 2-year program. The resident should have the opportunity to master the use of relevant electronic equipment, recording devices, and angiographic equipment necessary to perform cardiac catheterization. In addition, the program must provide the resident with the opportunity to learn the fundamentals of radiation safety.

Experience with preoperative and postoperative care of patients having cardiac surgery, both by closed and open methods, in close cooperation with the cardiothoracic surgical staff is required. A basic understanding of current surgical techniques, methods of cardiopulmonary bypass, and hypothermia is important for adequate training. The resident should understand and know how to manage postoperative complications, both immediate and delayed. Opportunity for long-term follow-up observations of both preoperative and postoperative patients must be afforded the resident.

The program must provide the resident with the opportunity for the study of rheumatic fever, collagen diseases, infective endocarditis, and other infections and metabolic conditions. The resident should be made aware of etiologic and risk factors in
hypertensive and atherosclerotic heart disease, including hyperlipidemic states, and
should gain experience in the diagnosis and management of patients with these car-
diovascular problems.

Research

A critical aspect of the training program is its research environment. There should
be evidence of a commitment to research and investigation in pediatric cardiology
and an ongoing active research program with investigation into clinical and basic as-
pects of various cardiovascular problems by the teaching staff. Within the institu-
tion, the resident should be exposed to and take part in research programs that
provide an environment conducive to a questioning attitude, to protocol develop-
ment, and to critical analysis. Ideally, the residents should help design, conduct,
evaluate, and prepare for publication a clinical or laboratory research project in the
area of cardiology. The completion of a research project during the training program
is strongly encouraged. The resident should be able to communicate his/her knowl-
dge to others, both orally and in written form, conduct lectures, seminars, and clin-
ical conferences, and prepare a written report of his/her research activities either for
faculty review or publication.

Administration

Residents should gain experience in organizational responsibilities necessary to
their role as pediatric cardiologists in the community. They should be exposed to
methods of organization of the cardiac catheterization laboratory, the outpatient
clinic, organization of a teaching service, and organization and day-to-day function
of the entire cardiology team. They should have the opportunity to interact with
Crippled Children’s Services, insurance companies, community resources, and
others necessary to the proper care of children with cardiac problems.

Conferences

Conferences must be held on a regular basis in the areas of clinical diagnosis and
therapy, cardiovascular research, and clinical morphologic correlations. Confer-
ences with other disciplines such as physiology, pharmacology, pathology, neonat-
ology, cardiovascular radiology, cardiothoracic surgery, and adult cardiology are
encouraged.

Neonatology

Special Requirements for Programs in Neonatal–Perinatal Medicine (2)

The purpose of the training program in neonatal–perinatal medicine is to provide
residents with the background to understand the physiology of the normal neonate
and the pathophysiology of the sick infant and to diagnose and manage problems of
the newborn. The program should be organized and conducted so as to assure an ap-
propriate environment for the well-being and care of the patients as well as one that stresses the development of appropriate attitudes on the part of the residents.

Training programs in neonatal–perinatal medicine must exist in conjunction with an accredited 3-year pediatric residency program and an accredited obstetrical residency program. These postgraduate programs should not dilute the experience with patients available to the core program; rather, the presence of these programs should assure the availability of all facilities and personnel necessary for the complete care of the infant and adolescent patient. A thorough knowledge of the growth and development of the normal infant as well as a broad understanding of all aspects of child care are prerequisites for the proper management of disorders of the fetus or newborn.

Duration of Training

Programs in neonatal–perinatal medicine must provide 2 years of progressive educational experience and responsibility in the various aspects of fetal and neonatal medicine.

Scope of Training

The training program must emphasize fundamentals of clinical diagnosis and management. Opportunity must be provided for the resident to participate in the diagnosis and management of problems seen in the continuum of the development of the fetus through prenatal, intrapartum, and neonatal periods, including follow-up. The resident should have the opportunity to develop an appreciation of the social implications of disorders of the fetus and newly born infant. The resident must have the opportunity to learn to identify the high-risk pregnancy, to evaluate fetal well-being and maturation, and to become familiar with the aberrant factors that may develop during the intrapartum period. The resident must have the opportunity to develop special competence in the management of critically ill newborn infants, including techniques of neonatal resuscitation, preparation for transport, ventilatory support, continuous monitoring, temperature control, nutritional support, and general principles of critical care. The resident must also be made aware of laboratory techniques essential to the care of the high-risk infant. Residents should have the opportunity for teaching and for assuming some departmental administrative responsibilities. Experience in tabulating and evaluating institutional and regional fetal neonatal morbidity and mortality should be provided. There should also be experience and instruction in techniques of collation and critical interpretation of data pertaining to immediate outcome and sequelae of various disease entities, such as hyaline membrane disease, asphyxia, neonatal sepsis, and erythroblastosis. This experience should be closely related to the evaluations of various modalities of therapy used in these disorders. The opportunity for long-term follow-up of high-risk infants must be provided.
The program should provide the opportunity for resident participation in regularly scheduled multidisciplinary conferences, such as sessions that review perinatal mortality, morbidity, and patient care, as well as participation in case conferences and current literature and research conferences.

The training program should include instruction in related basic sciences. Seminars, conferences, courses, and appropriate laboratory experiences should be offered in the basic disciplines related to pregnancy, the fetus, and the newborn. Examples are maternal physiological, biochemical, and pharmacological influences on the fetus; fetal physiology and development; placental function (placental circulation, gas exchange, growth); physiological and biochemical adaptation to birth; physiology, biochemistry, pharmacology, and pathology relevant to diseases of the newborn; psychology of pregnancy and maternal–infant interaction; growth and nutrition; genetics; epidemiology; and biostatistics.

Research

A critical aspect of the training program is its research environment. There should be evidence of a commitment to research and investigation in neonatal–perinatal medicine and ongoing active research with investigation into clinical and basic aspects of various related problems by the teaching staff. Within the institution, the resident should be exposed to and take part in research programs that provide an environment conducive to a questioning attitude, to protocol development, and to critical analysis. Ideally, the residents should help design, conduct, evaluate, and prepare for publication a clinical or laboratory research project in the area of neonatal–perinatal medicine. The completion of a research project during the training program is strongly encouraged. The resident should be able to communicate his knowledge to others, both orally and in written form, conduct lectures, seminars, and clinical conferences, and prepare a written report of his or her research activities, either for faculty review or publication.

Pediatric Hematology/Oncology

Special Requirements for Programs in Pediatric Hematology/Oncology (3)

The purpose of the training program is to provide residents with the background to diagnose and manage hematologic and oncologic diseases. This background includes an understanding of the physiology of blood and bone marrow function, as well as the pathophysiology of hematologic disorders and malignant disease.

Training programs in pediatric hematology/oncology must exist in conjunction with accredited 3-year pediatric residency programs, but should not dilute the experience with patients available to the core program. Rather, the presence of these programs should assure the availability of all facilities and personnel necessary for the complete care of the infant, child, and adolescent patient. A thorough knowledge of the growth and development of the normal child as well as a broad understanding of
all aspects of child care are prerequisites for the proper management of patients with hematologic and oncologic problems.

**Duration of Training**

Programs must provide 2 years of progressive educational experience and responsibility in the element of pediatric hematology and oncology.

**Scope of Training**

The training program must emphasize the fundamentals of clinical diagnosis, with special emphasis on history taking and physical examination. A program in pediatric hematology/oncology should provide enough clinical experience with both inpatients and outpatients who have hematologic and oncologic disorders for the residents to develop facilities in diagnosing and managing common and unusual problems.

The program should include hematologic disorders of the fetus and newborn; congenital and acquired disorders of red blood cells, white blood cells, and platelets; bone marrow failure; myeloproliferative disease; disturbances of iron metabolism; congenital and acquired coagulation defects; hemoglobinopathies; immunodeficiencies; leukemia; histiocytosis; and solid tumors of organs, soft tissue, and bone.

In addition to specific hematologic and malignant disorders, the resident must have the opportunity to become familiar with all aspects of chemotherapy, including treatment protocols and management of complications, diagnosis and treatment of infections in the compromised host, appropriate use of transfusion of the various blood components, plasmapheresis, and bone marrow transplantation. The resident should learn the methods of physiologic support of the cancer patient, including parenteral nutrition, control of nausea, and management of pain. The staging and classification of tumors, complete knowledge of the application of multimodal therapy, learning to function as a member of the "oncology team," learning the epidemiology and etiology of childhood cancer, making good observations, and keeping accurate patient data are vital aspects of pediatric oncology training. The resident should participate in the activities of the tumor board and in the provision of comprehensive care to the child with cancer. He should have experience in support of the patient, family, and staff in dealing with terminal illness. Development of skills in communication and counseling is important for the resident.

The residents should have the opportunity to teach, organize educational conferences, and develop elementary skills in medical writing.

The residents must be exposed to the proper use of laboratory techniques for diagnosis. There should be particular emphasis on recognition of the limitations of the various methods and pitfalls in interpretation of laboratory results. They should be familiar with the normal variations in laboratory data that occur at different ages, and should know the influence of medications, toxins, and systemic disease on hematologic values.
The residents should be provided with a background to enable them to use the diagnostic procedures of hematology and oncology. These include the performance and interpretation of bone marrow aspiration and biopsy, venipuncture, lumbar puncture with evaluation of cerebrospinal fluid, use of the microscope, and interpretation of peripheral blood films. Appropriate educational experiences in the laboratories, including blood bank and tissue pathology, should be included.

The residents should be able to use the diagnostic services of radiology, nuclear medicine, computerized tomography, sonography, angiography, clinical chemistry, microbiology, immunology, and genetics in the evaluation of patients with hematologic and oncologic disorders.

The training program should provide instruction in the related basic sciences. These include structure and function of hemoglobin and iron metabolism, the phagocytic system, immunology, splenic function, cell kinetics, immunology, coagulation, genetics, the principles of radiation therapy, the characteristics of malignant cells, tissue typing, blood groups, characteristics of chemotherapeutic agents, microbiology and anti-infective agents in the compromised host, bone marrow transplantation and graft versus host disease, and nutrition.

Research

A critical aspect of the training program is its research environment. There should be evidence of a commitment to research and investigation in pediatric hematology/oncology and ongoing active research with investigation into clinical and basic aspects of various related problems by the teaching staff. Within the institution, the resident should be exposed to and take part in research programs that provide an environment conducive to a questioning attitude, to protocol development, and to critical analysis. Ideally, the residents should help design, conduct, evaluate, and prepare for publication a clinical or laboratory research project in the area of hematology/oncology. The completion of a research project during the training program is strongly encouraged. The resident should be able to communicate his knowledge to others, both orally and in written form, conduct lectures, seminars, and clinical conferences, and prepare a written report of his or her research activities, either for faculty review or publication.

Pediatric Endocrinology

Special Requirements for Programs in Pediatric Endocrinology (4)

The purpose of the training program is to provide the resident with the background to diagnose and manage endocrine diseases and to understand the physiology of hormonal regulation in childhood and adolescence. The program should be organized and conducted so as to assure an appropriate environment for the well-being and care of the patients as well as one that encourages scholarship on the part of the residents.
Training programs in pediatric endocrinology must exist in conjunction with an accredited 3-year pediatric residency program; these postgraduate programs should not dilute the experience with patients available to the core program. Rather, the presence of these programs should assure the availability of all facilities and personnel necessary for the complete care of the infant, child, and adolescent patient. A thorough knowledge of the growth and development of the normal child as well as broad understanding of all aspects of child care are prerequisites for the proper management of individuals in the pediatric age group with endocrinologic problems.

Prerequisite training for entry into a pediatric endocrinology program must include the satisfactory completion of a pediatric residency, or its equivalent.

\textit{Duration of Training}

Programs must provide 2 years of educational experience in pediatric endocrinology and responsibilities for the care of patients with endocrinologic and metabolic disorders. While the training of an individual physician need not be confined to a single approved center, such training in a non-approved institution should not be more than 3 months of every year of training.

\textit{Scope of Training}

The training program must emphasize fundamentals of clinical diagnosis, with special emphasis on history taking and physical examination. Overall training should provide for progressive educational experience and responsibility. A training program in pediatric endocrinology should include a sufficient number of patients for clinical experience to allow the trainee to obtain in-depth knowledge of the management of infants, children, and adolescents with endocrinologic disorders. The clinical program must provide sufficient experience in the management of ambulatory patients with diabetes mellitus as well as experiences with the hospitalized diabetic. General endocrinological problems, which the resident should care for, should include children referred for short stature; constitutional delay; genetic short stature; growth hormone deficiency; disorders of thyroid hormone physiology, secretion, and synthesis; disorders of adrenal glucocorticoid physiology, secretion, and metabolism; disorders of androgen excess and metabolism; the management of thyroid nodules and neoplasms; disorders of sexual development; disorders of calcium and phosphorus metabolism, including rickets, parathyroid disorders, and vitamin D metabolism; disorders of fluid and electrolyte metabolism, including diabetes insipidus; and disorders of aldosterone metabolism. There must be clinical exposure to children with carbohydrate disorders, including diabetes mellitus and hypoglycemia. The residents should be involved in the care of adolescents in order to gain knowledge of normal pubertal and hormonal alterations occurring during this phase of life and abnormal conditions, such as pituitary deficiency and gonadal dysfunction.
The trainees must be exposed to the proper use of laboratory techniques for measurement of hormones by body fluids; particular emphasis should be placed on recognition of the limitations and pitfalls of interpretation of laboratory results. They should be familiar with normal variations that occur in laboratory data at different ages. Residents should be provided with the background that will enable them to use the diagnostic procedures of endocrinology involving radiology and nuclear medicine; formal rotations through such laboratories should be included. An opportunity must be available for the resident to learn about the pertinent aspects of genetics. Particular emphasis should be placed on the areas of counseling, biochemical genetics, cytogenetics, and their phenotypic expression.

The training program should include instruction in related basic sciences. These include endocrine physiology and biochemistry; embryology of endocrine and related systems, with emphasis on sexual differentiation; genetics, including laboratory methods, cytogenetics, and enzymology; and aspects of immunology pertinent to understanding endocrine disease and the use of immunoassays. The training program should include a meaningful exposure to endocrinological research and should identify a defined segment of time during which the resident participates in such scholarly activity.

Research

A critical aspect of the training program is its research environment. There should be evidence of a commitment to research and investigation in pediatric endocrinology and an ongoing active research, with investigation into clinical and basic aspects of various endocrinologic problems by the teaching staff. Within the institution, the resident should be exposed to and take part in research programs that provide an environment conducive to a questioning attitude, to protocol development, and to critical analysis. Ideally, the residents should help design, conduct, evaluate, and prepare for publication a clinical or laboratory research project in the area of endocrinology. The completion of a research project during the training program is strongly encouraged. The resident should be able to communicate his or her knowledge to others, both orally and in written form, conduct lectures, seminars, and clinical conferences, and prepare a written report of his or her research activities, either for faculty review or publication.

Pediatric Nephrology

Special Requirements for Programs in Pediatric Nephrology (5)

The purpose of the training program is to provide the residents with the background to diagnose and manage renal diseases and to understand the physiology of fluid and electrolyte regulation in humans. The program should be organized and conducted so as to assure an appropriate environment for the well-being and care of
the patients while stressing the development of appropriate attitudes on the part of the residents.

Training programs in pediatric nephrology must exist in conjunction with an accredited 3-year pediatric residency program. These postgraduate programs should not dilute the experience with patients available to the core program; rather, their presence should assure the availability of all facilities and personnel necessary for the complete care of the infant, child, and adolescent. A thorough knowledge of the growth and development of the normal child as well as a broad understanding of all aspects of child care are prerequisites for the proper management of individuals with renal and genitourinary problems, hypertension, and disorders of body fluid physiology.

**Duration of Training**

Programs in pediatric nephrology must provide 2 years of progressive educational experience and responsibility.

**Scope of Training**

The training program must be designed to develop the physician’s competence in the clinical diagnosis, pathophysiology, and medical treatment of disorders of the kidneys, urologic abnormalities, hypertension, and disorders of body fluid physiology in infants, children, and adolescents. Experience shall be provided in the therapy of end-stage renal disease, including dialysis and renal transplantation. Training in the selection, performance, and evaluation procedures necessary for morphological and physiological assessment of renal disease must be included. The program must provide the opportunity for the residents to teach in a variety of settings and to participate in basic science laboratory and clinical research. Opportunity must also be provided for residents to develop competence in counseling chronically ill patients and their families.

The program should offer instruction through courses, workshops, seminars, or laboratory experience to provide an appropriate background for residents in the basic and fundamental disciplines related to the kidney, such as embryology, physiology, pharmacology, pathology, immunopathology, genetics, biochemistry, and parenteral nutrition.

**Research**

A critical aspect of the training program is its research environment. There should be evidence of a commitment to research and investigation in pediatric nephrology and on-going active research, with investigation into clinical and basic aspects of various related problems by the teaching staff.

Within the institution, the resident should be exposed to and take part in research
programs that provide an environment conducive to a questioning attitude, to protocol development, and to critical analysis. Ideally, the residents should help design, conduct, evaluate, and prepare for publication a clinical or laboratory research project in the area of nephrology. The completion of a research project during the training program is strongly encouraged. The resident should be able to communicate his/her knowledge to others, both orally and in written form, conduct lectures, seminars, and clinical conferences, and prepare a written report of his/her research activities, either for faculty review or publication.

At present, detailed descriptions of programs in pediatric pulmonary disease and pediatric critical care medicine are being developed but have not been approved for publication.

In the United States (USA), there is a separate accrediting body in allergy/immunology that has developed a description of the educational program in allergy/immunology. Pediatric allergists/immunologists are expected to complete educational experiences that involve adults as well as children. For an individual to enter a fellowship in allergy/immunology he/she must first finish a complete program in general pediatrics or general internal medicine.

Individuals who seek education as pediatric neurologists or pediatric psychiatrists must first complete educational experiences in adult psychiatry or adult neurology before they begin subspecialty educational programs in pediatric neurology and pediatric psychiatry, respectively. They do not need to complete a residency in pediatrics.

There are presently no nationally accepted descriptions of fellowship programs in gastroenterology, infectious disease, adolescence, genetics, rheumatology, or behavioral pediatrics/child development.

CERTIFICATION OF COMPETENCY/PROGRAM ACCREDITATION

In the USA, for those subspecialty areas that have approved national statements which describe their educational programs, there is a system both to evaluate the competency of individuals who have completed the program and to serve as a process for evaluating the quality of the educational program.

All individuals who desire certification as a subspecialist in one of these nationally defined areas are presently required to pass a written examination at the conclusion of their educational experience. In the areas of pediatric neurology and psychiatry, there is an oral examination.

A detailed review of the structure of the subspecialty educational program by an external body is required of all those nationally defined subspecialties described above. A database is developed that describes the curriculum of each program, the financial resources of the program, the space available for patient care/research/education, the size and quality of the faculty, the numbers and types of patients, the systems for evaluating students and the program, and the success of program graduates on subspecialty certification examinations. An outside expert in medical education
visits the program and analyzes the database with the help of the program director, faculty, and students. This analysis and database are then reviewed by an accrediting body composed of medical specialists and subspecialists. This panel will then recommend disapproval or approval for a period of time from 1 to 6 years.

ISSUES CONCERNING THE EDUCATION OF PEDIATRIC SUBSPECIALISTS

There are inconsistencies in the educational process for pediatric subspecialists in the USA. In the majority of subspecialty areas, a foundation in general pediatrics is considered a prerequisite for entrance into the subspecialty program. However, in certain subspecialties, such as allergy/immunology, pediatric neurology, and pediatric psychiatry, such an educational experience is not required. It would seem irrational to consider an internist or a neurologist with no training in general pediatrics competent to manage the problems of the child in these two areas. Also, the individual without a formal educational experience in general pediatrics may be less well suited to deal with the general pediatrician in the ongoing care of the child who needs to be managed jointly by the generalist serving as the primary care physician and the subspecialist serving as consultant.

The length of formal education in the subspecialties has been debated vigorously over the past few years. Recently, subspecialty leadership in the USA has recommended increasing the length of education in the defined pediatric specialties from 2 to 3 years. The extra year would allow more time for formal research experiences to be integrated into the program. Some have argued that not all pediatric subspecialists need to be competent researchers. Others believe that it is important that the subspecialist be prepared for positions in academic medicine and that competency in research is essential for a successful academic career. There is another position that argues that many subspecialists will join the ever-growing number of multispecialty group practices. In such positions, there is often little time for research. Subspecialists in such a setting need to have the ability to manage patients competently and to participate in a variety of educational activities. In the USA those responsible for the funding of positions in graduate medical education have been very concerned about the increased cost associated with this recommendation to increase the length of the subspecialist’s educational experience.

As noted above, there are a number of important pediatric subspecialties that have not yet reached the stature of being recognized and defined nationally. This creates an odd dichotomy. There are programs that educate individuals in these undefined areas; however, these programs are not accredited, and the graduates of these programs are not evaluated and certified by a national body. Therefore, from the public’s perspective, there is less assurance about the ability of individuals who call themselves experts in pediatric infectious disease than individuals who are board-certified cardiologists. Interestingly enough, there is subspecialty certification and accreditation in more areas of internal medicine than pediatrics in the USA.
There has been debate in the USA over the number of the various subspecialists needed to serve the health care, educational, and research needs of the country. At present, the number of subspecialists being educated for the defined pediatric subspecialties is determined through the previously described process of accreditation. It is the availability of faculty resources and space that limits the size of educational programs. Ultimately, it will be the availability of full-time positions in academic medicine or multigroup practices and restriction of support for graduate medical education from third-party payers that may limit the number of individuals entering a particular pediatric subspecialty.

In 1980, a special study was commissioned by the US federal government to study the need for various specialists and subspecialists from the standpoint of the health care needs of the American public (6). This study predicted that by 1990 there would be an excess of nearly 5,000 general pediatricians and pediatric subspecialists. The study was unable to identify the subspecialist areas in which significant excesses were going to occur. Recently, a second federal group has studied this problem and determined that there may well be an oversupply of subspecialists in the coming year (7). These findings may have an impact on the level of federal funds made available to subspecialty educational programs. Unfortunately, these studies do not account for the need for researchers in these same areas. Can one predict the number of pediatric infectious disease scientists on the basis of health care needs alone?

Those involved with the education of pediatricians and pediatric subspecialists must also be concerned about the impact of the fragmentation of pediatrics and the effect of this fragmentation on the role of the general pediatrician. Will the public want a generalist when they can easily find an available subspecialist? In the USA the yuppy generation has certainly learned that it is critical to have your child born in a hospital with a staff of neonatologists. Why continue to take your child with allergies to the general pediatrician when there is an easily accessible allergist? Should one not seek out an expert in adolescent problems as the child approaches those complex and critical years? What should be the role of the general pediatrician in this new world of multiple, easily available subspecialists, particularly when there are family practitioners who claim they can do as good a job as the general pediatrician in caring for the day-to-day problems of the child and family?

There are active discussions in the USA between those groups responsible for the education of pediatricians, internists, and family practitioners about the possibility of educating the generic primary physician (possibly with special competence in the care of the child or the aged). This would be a dramatic step that could, over the next generation, disenfranchise the general pediatrician, general internist, and family practitioner. It seems that such a redefinition would have an impact internationally as well as within the USA. There is a need for those who teach pediatrics around the world to carefully study the structure of pediatric subspecialty and general pediatric education to determine what would be the best and most rational formulation of educational programs for those individuals who will care for children and their families, conduct research to decrease the morbidity and mortality of infants, children, and adolescents, and to educate the next generation of health care providers.
SUMMARY

The various roles of the pediatric subspecialist are presented, as well as the subspecialty areas currently offering educational programs to prepare pediatricians and other physicians to provide care to infants, children, and adolescents. A description is provided of the nature of approved pediatric subspecialty programs in pediatric cardiology, neonatology, pediatric hematology/oncology, pediatric nephrology, and pediatric endocrinology. The process of certification and accreditation is described for these approved programs.

Educational issues are discussed in pediatric subspecialty education: the significant variations in the process of education for different pediatric subspecialties; the debate over proposed changes in the length of subspecialty educational programs; the dichotomy between subspecialty programs that are approved and those that are not, as well as the impact of such differences on the public; the process for determining the appropriate number of pediatric subspecialists; the impact of the potential fragmentation of health care by the development of more types of pediatric subspecialists, as well as increasing numbers of these subspecialists; and the emergence of the family medicine practitioner as a primary care provider for children and the impact on general pediatrics.

REFERENCES


DISCUSSION

Dr. Guesry: I may be being a little provocative, but I think that sometimes we need to be. After I left pediatrics to become more involved in business and management, I was sent to business school. There I was told that a good manager should rank his priorities so that he allocates his resources, which are always limited even if you are very well funded, to the
projects he perceives as most important. I am sure that in industrialized countries as well as in developing countries, there is a problem of resources. I am surprised that so far I have not heard anything about cost–benefit evaluation. How can we allocate resources to be more efficient?

Dr. Burg: Let me answer this in terms of setting priorities for an educational program. Unless you determine what the person you are educating is supposed to learn to do, and unless you go into the details of what are the skills and abilities that you want this person to acquire during an educational experience, you cannot form any priorities.

Dr. Guesry: I was referring more to public health activities, which to me remain the most efficient way of benefiting the population. I believe that in industrialized countries, we may be forgetting the benefit of public health measures.

Dr. Burg: Professor Gabr was responsible for the development of one of the most exciting public health programs, saving the lives of thousands of children in Egypt by instituting a widespread program of oral rehydration therapy. As a pediatrician, he had a national impact. My belief is that if we were to define one of the essential competences of a pediatrician as the ability to develop educational programs for the people, and all the various subsets of competences under that, we would have a phenomenal effect on the type of health care given. The problem is that we have not been explicit in what we think we want our students to be able to do and, until we are explicit, it will be hard to set priorities and provide direction.

Dr. Canosa: Assuming that a given department of pediatrics fulfills your requirements, how are you going to evaluate the impact and the results of these factors on the quality of pediatric training?

Dr. Burg: I think if you look at the various elements of the system and determine whether they are present in the program, you will have an opportunity to determine whether it is a high-quality educational program. By doing this, you would be evaluating the process of the educational program. Your question is a very important one in terms of looking at outcomes and the kind of demographic information we have been discussing. One of the exciting things about a conference such as this is that it provides a forum for us to begin to look at the impact of educational programs from a demographic point of view. It is hoped that assessment techniques will become more sophisticated and that we will develop measures that will allow us to acquire more detailed information about the quality of life for infants and children in the coming years.

Dr. Canosa: You said that the number of individuals applying for training in pediatrics is declining in the USA. What will be the outcome of this? Do you think that there will be a decrease in the quality of life of your children, or will somebody else take care of the needs of children besides pediatricians?

Dr. Burg: The figures were correct. At peak, we had over 40,000 applicants for training in US medical schools, and we are now down to approximately 25,000 applicants. The question whether the quality of practice is going to suffer over the coming years is a very important one for the United States. I am certain that our system will adjust to this phenomenon through actions taken at a national level, because consumers in the United States will not allow the quality of health care to deteriorate.

Dr. Cravioto: Would you tell us something about the reasons for this decrease in interest in a career in pediatrics? Does it concern money?

Dr. Burg: We believe that a great part of the reason is indeed concerned with the financial aspects of going into pediatrics. In the United States, the average debt of newly graduated doctors is approaching $50,000. Although there are specialists in the USA with average salary levels exceeding $100,000 per year, pediatricians are unfortunately not among this group.
You should also be aware that in the United States, there is not only a decline in interest in pediatrics, but in internal medicine and family medicine as well.

*Dr. Sawyer:* Another possible factor deserve comment. Pediatricians work very hard. They have long hours and are frequently on call. The same is true for a number of other medical fields that have experienced a decline in interest. The lifestyle of pediatricians, general internists, and family practice physicians seems increasingly to be perceived as less desirable than that of doctors in other fields in which physicians can schedule 8- to 10-hour days. The development of newer practice styles, such as large multispecialty group practices and salaried group practices, may help. Another issue is that of the legal aspect of medical practice. Legal issues are now a significant problem for the pediatrician because in the USA the statute of limitations for a malpractice claim has been very much delayed—until the age of maturity—before the “clock” starts to run. The result is a very long tail of liability. This issue may be a deterrent to a career choice in pediatrics, particularly in the high-risk pediatric specialties, such as neonatology.

*Dr. Visakorpi:* I think it is a general phenomenon that there are fewer applicants for medical faculties. Maybe this is not a bad thing, and we are now getting a different kind of person applying to enter medicine. There are certainly more women.

*Dr. Burg:* Fortunately, we have had many more women entering medicine from the mid-1970s. Presently, about 40% of applicants to medical schools in the USA are women. However, we have seen a plateau in the number of female applicants, and perhaps even a slight decrease in the past few years. We also have some information about the performance of medical students on the National Board’s part 1 examination. In the past years, there has been close to a 20% failure rate, which is the highest it has been for 10 years. This is creating a great deal of concern as to the question of competence and quality.