

NATIONAL POSTGRADUATE MEDICAL COLLEGE OF
NIGERIA



CURRICULUM FOR SUB-SPECIALTY IN PAEDIATRIC
NEUROLOGY

FACULTY OF PAEDIATRICS

APPROVED BY THE SENATE ON 23RD JULY,
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A handwritten signature in red ink, appearing to read 'Dr. Owoidoho Udofia'.

DR OWOIDOHO UDOFIA, FMCPsych
COLLEGE REGISTRAR

NATIONAL POSTGRADUATE MEDICAL COLLEGE OF NIGERIA

FACULTY OF PAEDIATRICS

SUB-SPECIALTY TRAINING IN PAEDIATRIC NEUROLOGY

Preamble

The junior residency rotations preceding the Part I Membership Examination in Paediatrics provides a solid platform for any resident who is interested in the sub-specialty of paediatric neurology to pursue sub-specialty training in the discipline. After the Part I examination, any resident who is interested in sub-specialty Paediatric Neurology shall undergo additional three years in the residency training programme before the final Fellowship examination.

The practice of paediatric neurology involves the diagnosis and treatment of children with diseases affecting the central nervous system, the peripheral nervous system and the autonomic nervous system. A paediatric neurologist is a skilled clinician who reaches a diagnosis by taking a detailed history and performing thorough neurological and developmental examinations, supplemented by the rational use of appropriate investigations. A detailed knowledge of normal child development together with a broad understanding of paediatrics is mandatory for every paediatric neurologist. The paediatric neurologist must harness the information obtained from history with the findings obtained on a skilful neurologic examination to arrive at a logical set of differential diagnoses, being well aware of the evidence that support the management decisions taken on every patient.

Paediatric neurologists by virtue of many paediatric neurological disorders requiring multi-disciplinary interventions, are required to work closely with other specialists in related disciplines and these include other paediatricians, neurosurgeons, child/adolescent psychiatrists, neuroradiologists, neuropathologists and neurogeneticists. They are also expected to possess the requisite skills for the recording and interpretation of paediatric and adult

electroencephalography (EEG), electromyography (EMG) and nerve conduction studies (NCS). In addition, paediatric neurologists need to possess well-developed skills in the interpretation of paediatric neuro-imaging studies – CT/MRI as well as cranial ultrasound in young infants. Because many paediatric neurological disorders are chronic and disabling, good interpersonal and counselling skills are critical components of paediatric neurology practice.

General Objective

The objective of the sub-specialty training in Paediatric Neurology is to produce paediatricians who have a deep knowledge and a thorough understanding of the disorders of the nervous system that affect infants, children and young adults, and are highly skilled in providing the requisite care for these disorders.

Specific objectives

1. To produce Paediatricians who have expertise in the recognition of a wide range of neurological conditions that affect infants, children and young adults.
2. To produce Paediatricians who are capable of producing expert care for infants, children and young adults who have neurological disorders, both in the acute setting and on out-patient basis.
3. To produce Paediatricians who would work closely with other specialists in related disciplines (other paediatricians, neurosurgeons, neurophysiologists, neuropsychiatrists, neuroradiologists and neurogeneticists) to provide specialist support and advice for optimal outcomes in children.
4. To produce Paediatricians who have generic expertise in neuroimaging, neurophysiology and some basic aspects of neurogenetics.
5. To produce clinicians who are competent to provide at Consultant level, unsupervised, comprehensive care in the sub-specialty of paediatric neurology.

EXPECTED OUTCOMES OF TRAINING

At the end of the three year sub-specialty training in paediatric neurology, it is expected that the new Fellow will be able to:

1. Demonstrate a high level of competence in detailed history taking and skillful neurological examination.
2. Demonstrate a sound knowledge of basic neuroanatomy.
3. Effectively communicate with patients, their caregivers, other specialists and other healthcare professionals involved in the care of the child.
4. Possess a sound and broad knowledge of all common and many rare paediatric neurological disorders, recognise them at presentation and institute the appropriate management for optimal outcomes.
5. Confidently undertake routine inter-ictal EEG recording in adults and children and provide correct interpretations on all paediatric EEGs.
6. Possess generic skills in the interpretation of paediatric neuroimaging – CT scan, MRI and transfontanelle ultrasound.
7. Work as a member of a multidisciplinary team, respecting the roles of the other members of the team
8. Demonstrate the inherent skills required of a consultant paediatrician, particularly self-motivated learning, teaching and an understanding of basic research principles.

TRAINING STRUCTURE

	Posting	Duration
1.	General Paediatrics including Emergency Paediatrics, Neonatology and other elective rotations	12 months
2.	Paediatric Neurology I	6 months
3.	Adult Neurology	2 months
4.	Paediatric Neurosurgery	2 months

5.	Neuroradiology I	1 month
6.	Neuropathology	1 month
7.	Neurophysiology-** EEG -adult & Paediatric	2 months
8.	Paediatric Neurology II	6 months
	TOTAL	32 months

COURSE CONTENT & THEMES

A. BASIC NEUROLOGY

B. HISTORY TAKING

The trainee is expected to skilfully elicit the key features of the history. Important aspects would include the presenting complaints, the history of presenting complaints, pregnancy, birth, neonatal history, details of child developmental milestones, schooling, behaviour, play activities, immunisation and also the family and social history. The onset and duration of symptoms, course of the disease and all other related symptoms should be elicited and documented. The trainee is to display proficiency in the review of neurological symptoms and understand the localising value of each symptom.

C. NEUROLOGICAL EXAMINATION

The purpose of the neurological examination is to test the hypotheses generated when taking the history and to guide the choice of further investigations on the patient. The trainee is expected to be competent in the examination of the nervous system, including the mental state, cognition, cranial nerves, motor system, cerebellar functions and the sensory system. Neurological examination in infants and young children also includes the assessment of the different stages of normal development. The trainee paediatric neurologist is expected to be proficient with regards to the peculiarities of the technique of neurological examination in the paediatric age group which include a great emphasis on observation, the establishment of trust and the use of game play. In addition, the trainee is expected to take a professional and ethical approach to patient examination and to adapt examination methods depending on the behavioural and cognitive state of the child.

D. Formulate a diagnosis, differential diagnoses and management plan

At the end of the training, the new Fellow should be able to synthesize the key information obtained from the history, physical examination and the results of investigations to arrive at a definitive diagnosis and a set of logical differential diagnoses and to formulate a management plan for optimal outcomes in the patient. He/she should be able to revise the diagnosis when new information becomes available, collaborate and participate in multidisciplinary teams and make referrals to other specialists.

E. Basic Neuro-anatomy

A. SPINAL CORD

- Gross anatomy
- Nerve roots
- Rami communications
- Central grey matter
- White matter – Ascending pathways, Descending pathways

B. BRAIN STEM : MID-BRAIN, PONS, MEDULLA

- Gross anatomy
- Ascending pathways
- Descending pathways
- Nuclear complexes
 - Mid brain – Substantia nigra, Red nucleus, Peri-aqueductal grey matter, Inferior colliculus, Medial geniculate nucleus. Superior colliculus, Trochlear nucleus, Oral motor nucleus, Edinger-Westphal nucleus.
 - Pons – Facial nucleus, Abducens nucleus, Vestibular nucleus, Trigeminal and sensory nuclei, Superior olivary complex
 - Medulla – Gracile and cuneate nuclei, hypoglossal nucleus, dorsal nucleus of Vagus, Nucleus of tractors solitarius, medial and lateral vestibular nuclei, Nucleus ambiguous, inferior olivary nucleus, nucleus of spinal tract of trigeminal nerve.

C. CRANIAL NERVES

- *Sensory*
 - Visceral sensory – Nucleus tractus solitarius
 - Somatic sensory – Principal sensory nucleus, mesencephalic nucleus and spinal tract of trigeminal nerve
 - Special sensory – Cochlear nucleus,
- *Motor*
 - Somatic motor- oculomotor nucleus, trochlear nucleus, abducens nucleus, hypoglossal nucleus.
 - Special motor nucleus – trigeminal motor nucleus, facial nucleus, nucleus ambiguus, spinal accessory nucleus.
 - Visceral motor – Edinger-Westphal nucleus, superior and inferior salivary nucleus, dorsal vagal nucleus

D. CEREBELLUM

- Gross anatomy
- Afferent pathways
- Efferent pathways
- Nuclear complexes
- Cerebellar cortex

E. HYPOTHALAMUS

- Gross anatomy
- Primary divisions of the hypothalamus

F. THALAMUS

- Gross anatomy
- Internal medullary lamina nuclear groups

G. LIMBIC SYSTEM

H. BASAL GANGLIA

I. CEREBRAL CORTEX

- Afferent and Efferent
- Internal capsule
- Functional divisions of the cerebral cortex

- Microscopic anatomy
- Anterior circulation – divisions of the internal carotid artery
 - Ophthalmic artery, anterior cerebral artery, middle cerebral artery
- Posterior circulation – divisions of the vertebrobasilar system
 - Vertebral artery, basilar artery, posterior cerebral artery

F. Neurochemistry and Neuropharmacology

1. Classification of neurotransmitters- acetylcholine. Monoamines, neuropeptides, amino acids, nitrous oxide.
2. Mechanisms of function of neurotransmitters
3. Membrane characteristics – membrane potentials, ion channel structure

G. Neuropathology

General response of the brain to injury or disease

- Brain oedema
 - Vasogenic
 - Cytotoxic
 - Interstitial
 - Hypo-osmotic
 - Hydrostatic
- Neuronal changes
 - Neuronal loss or atrophy
 - Ischaemic necrosis
 - Inclusion bodies
 - Neurofibrillary degeneration
 - Central chromatolysis
 - Neuronal storage
- Astrocyte reaction
- Oligodendrocytes

H. Normal Brain Development

- Neurulation and neural tube derivatives
- Early brain vesicles
- Development of sulci and gyri
- Brain fissure development
- Development of the cerebellum
- Development of the corpus callosum

I. Normal Child Development

- Definitions
- Theories of development
- Developmental timing and plasticity
- Domains of development
- Developmental milestones
- Attachment
- Critical and sensitive periods
- Prematurity and child development
- Developmental monitoring – surveillance, screening and diagnostic evaluation

B. DISEASES OF THE NERVOUS SYSTEM IN CHILDREN

I. Diseases presenting in the neonatal period

The new Fellow is expected to be able to assess, diagnose and manage neurological disorders presenting in the neonatal period.

Common neonatal neurologic disorders include:

- Hypoxic ischaemic encephalopathy
- Neonatal seizures
- Diseases of prematurity
- Hypotonia
- Stroke
- Congenital and neonatal infections
- Inborn errors of metabolism

- Cerebral malformations and dysmorphic syndromes
- Prenatal disorders and maternal diseases

II. Congenital Malformations of the head, brain and spinal cord

The new Fellow is expected to be able to assess, diagnose and manage neurological disorders resulting from congenital malformations of the brain and the spinal cord.

- a. Disorders of neural tube closure
 - i. Spinal bifida occulta
 - ii. Myelomeningocele
 - iii. Meningocele
 - iv. Spinal dysraphism – tethered cord, syringomyelia, diasthematomyelia
 - v. Anencephaly
 - vi. Encephalocele
 - vii. Arnold-Chiari malformation
- b. Disorders of brain segmentation
 - i. Schizencephaly
 - ii. Holoprosencephaly
 - iii. Septo-optic dysplasia
 - iv. Dandy-Walker malformation
- c. Disorders of neuronal and glial proliferation
 - i. Microcephaly
 - ii. Megalencephaly
- d. Disorders of neuronal migration
 - i. Lissencephaly
 - ii. Focal cortical dysplasia
- e. Disorders of cortical organisation
 - i. Polymicrogyria
- f. Disorders of cytogenesis
 - i. Congenital vascular malformations
 - ii. Congenital neoplasm of the brain
- g. Disorders of CSF secretion and absorption
 - i. Hydrocephalus

- h. Malformations of the head
 - i. Craniosynostosis
 - ii. Brachycephaly
 - iii. Plagiocephaly
 - iv. Scaphocephaly

III. DEVELOPMENTAL DISORDERS

The new Fellow is expected to be able to assess, diagnose and manage children who present with developmental delay or developmental regression.

Common developmental disorders in children include:

- Cerebral palsy
- Intellectual disability (Mental retardation)
- Attention deficit hyperactivity disorder
- Autism spectrum disorders
- Neurodegenerative disorders – ataxia telangiectasia, sub-acute sclerosing panencephalitis

IV. SEIZURES IN CHILDREN

The main learning objective in this module is to be able to assess, diagnose and manage children presenting with seizures. The new Fellow is expected to be able to evaluate a patient with a possible seizure, formulate a set of differential diagnoses based on history, seizure semiology, physical examination and investigations and appropriately manage the seizures. He/she is expected to be able to distinguish between epilepsy and non-epileptic events.

The following aspects of seizures in children must be covered:

- Febrile seizures
 - Definition
 - Aetiology
 - Clinical presentation
 - Diagnosis
 - Treatment
 - Prevention
- Epilepsy
 - Definition

- Epidemiology
- ILAE Classification
- Generalised / Focal Epilepsies
- Epilepsy syndromes
- Epileptic encephalopathies
- Genetic epilepsies
- Neonatal and infantile epilepsies
- Investigations – EEG, Neuroimaging
- Treatment – anti-epileptic drugs, ketogenic diet, vagal nerve stimulation, epilepsy surgery
- Paroxysmal non-epileptic disorders
 - Benign neonatal myoclonus
 - Tics
 - Stereotypies
 - Night terrors
 - Self gratification
 - Syncopal attacks

V. Headache in children

The new Fellow is expected to be able to assess, diagnose and manage patients presenting with headache. He/she is expected to be able to differentiate primary from secondary headache.

Common types of headache in children include:

- Primary headache
 - Migraine
 - Tension type headache
 - Chronic daily headache
- Secondary headache
 - Due to raised intracranial pressure
 - Other causes

VI. Disorders of special senses

- Visual disorders – acute visual loss, chronic visual loss, cortical visual impairment, diplopia
- Auditory disorders – congenital deafness, acquired deafness

- Speech disorders – delayed speech, disorders of speech articulation

VII. Paediatric strokes.

- Perinatal acute ischaemic stroke
- Cerebral sino-venous thrombosis
- Intracranial haemorrhage
- Strokes in infants and older children/adolescents

VIII. Weakness

The new Fellow is expected to be able to assess, diagnose and manage a child presenting with weakness.

Neuromuscular disorders are important causes of weakness in children. These include:

- Diseases of the anterior horn cell – Spinal muscular atrophy, Poliomyelitis
- Diseases of the peripheral nerves – peripheral neuropathies, GBS, Erb's palsy, Bell's palsy, Klumpke's paralysis
- Diseases of the neuromuscular junction – Myasthenia gravis – congenital, neonatal transient, juvenile MG.
- Muscular dystrophies – Duchenne MD, facio-scapulohumeral MD, limb girdle MD, Becker's MD.
- Congenital myotonic dystrophy

IX. Movement Disorders

The new Fellow is expected to be able to assess, diagnose and manage disorders of movement in children.

- Chorea
- Myoclonus
- Dystonia
- Tics

X. Neurological emergencies

The new Fellow is expected to be able to assess, diagnose and manage neurological emergencies. Common neurological emergencies in children include:

- Status epilepticus
- Acute stroke
- Coma/altered consciousness
- Sudden onset weakness
- Encephalopathy
- Traumatic brain injury – non-accidental brain injury

XI. Intracranial Infections

The new Fellow is expected to be able to assess, diagnose and manage intracranial infections and their complications in children, including prevention.

- Bacterial Meningitis
- Viral meningo-encephalitis
- Sub-dural abscess
- Intracranial abscess

XII. Brain tumours in children

- Supratentorial tumours
- Infratentorial tumours

C. INVESTIGATIONS IN NEUROLOGY

i. Electroencephalography

The new Fellow is expected to be skilled in the technique of recording EEGs in neonates and children. He/she should also be able to correctly interpret/report paediatric EEGs.

A formal training and certification in paediatric EEG is mandatory.

The modules to be covered here include the following:

- Normal EEG patterns in preterm and term neonates
- Normal EEG patterns in infants and children
- EEG in neonatal and infantile epilepsies
- EEG in epilepsies in early childhood

- EEG in epilepsies in late childhood
- EEG in epileptic encephalopathies

ii. Neuroimaging

The new Fellow is expected to possess the basic skills for the interpretation of the images acquired by the underlisted:

- Cranial CT scan
- Transfontanelle ultrasound
- Transcranial Doppler ultrasonography
- Cranial MRI
- Spinal MRI

D. Additional competences

Adult neurology

Child psychiatry

Paediatric neurosurgery

E. Examination

This shall involve the following:

- A clinical examination
- An oral examination
- A dissertation in the field of paediatric neurology