

## ORIGINAL PAPERS / ARTICLES ORIGINAUX

**ESTABLISHING NEW NEUROSURGICAL FACILITIES IN RESOURCE-LIMITED SETTINGS:  
OVERCOMING CHALLENGES IN WEST AFRICA****CREATION D'UN CENTRE DE NEUROCHIRURGIE DANS LES PAYS AUX RESSOURCES LIMITEES :  
SURMONTER CE DEFI EN AFRIQUE OCCIDENTALE**OKON UDOH David <sup>1</sup>

1. Department of Surgery, University of Benin Teaching Hospital, Benin City, Edo State, Nigeria

E-Mail Contact - OKON UDOH David : [davidudoh07 \(at\) gmail \(dot\) com](mailto:davidudoh07@gmail.com)**Keywords:** *Neurosurgery ward, Neurosurgery department, Nigeria, Resources, Staff, West Africa.***Mot Clés :** *Afrique de l'Ouest ; Création ; Nigéria, service neurochirurgie ; personnel ; ressources***ABSTRACT****Background**

The first neurosurgical facility in West Africa was established in 1962 at the University College Hospital, Ibadan, Nigeria. However, by 2000, the average neurosurgeon to population ratio remained 1: 10,000,000

**Aim**

The purpose of this paper is to document the process of the establishment of a neurosurgical center in West Africa.

**Methodology**

We reviewed the records with respect to the establishment of the neurosurgical center at a University of Benin Teaching Hospital in West Africa. These records included references to reasons for establishment of the neurosurgical facility; building acquisition; staff recruitment and training; neurosurgical and diagnostic equipment acquisition; commencement of neurosurgical procedures. The challenges faced and strategies for overcoming them are also documented.

**Results**

Over five years, we established a fully dedicated neurosurgical facility with thirty specialty nurses and other in-house staff, and a capacity for thirty to forty-five in-patient admissions. Most neurosurgical conditions peculiar to the environment can now be managed at this facility.

**Conclusion**

With minimal available resources, a functioning neurosurgical unit may be established in almost any part of West Africa to meet the needs of the environment.

**RESUME****Contexte**

Le premier service de neurochirurgie en Afrique de l'ouest a été créé en 1962 au centre Universitaire Hospitalier d' Ibadan au Nigeria. Depuis lors, bien qu'un certain nombre d'unités de neurochirurgie aient émergées, la moyenne de neurochirurgien est de 10,000.000 de personnes à la fin du dernier du millénaire. Les raisons de cette pénurie ou du manque de centres de neurochirurgie est liée au coût et la durée de la formation du spécialiste et le prix de l'installation d'un centre fonctionnel. Le besoin pour des centres de neurochirurgie est particulièrement élevé à cause des accidents de la route et de l'insécurité civile accompagnant l'industrialisation.

**Objectifs**

Etablir un nouveau centre de neurochirurgie au Nigeria avec des infirmiers spécialisés en neurochirurgie, des ergothérapeutes et des physiothérapeutes.

**Méthodes**

Depuis Juin 2006, nous avons créé dans notre Centre Hospitalier Universitaire un centre de neurochirurgie à partir d'un bâtiment d'un hôpital inutilisé. Nous avons entraînés le personnel non-qualifié. L'accent a été mis sur la disposition d'un service essentiel à l'environnement en élargissant la possibilité de la formation aux différents niveaux et une réduction des coûts par l'hôpital pour former le personnel ailleurs.

**Résultats**

Cinq ans plus tard, nous avons créé un centre de neurochirurgie avec trente infirmiers spécialisés et du personnel associé, et une capacité de trente à quarante cinq lits pour l'hospitalisation. La plupart des conditions particulières de neurochirurgie à l'environnement est établie.

**Conclusion**

Avec de minime ressources disponible, une unité fonctionnelle de neurochirurgie peut être érigée dans presque n'importe quelle région l'Afrique occidentale pour répondre aux besoins locaux. En outre, la collaboration avec d'autres institutions locales et étrangères peuvent servir à combler les difficultés d'acquisition des installations, de ressources et de formation.

**INTRODUCTION**

A hospital that has neurosurgery must have teams of highly skilled neurosurgical nurses, interventional neuroradiologists, neuropathologists, neurologists, neuroanaesthesiologists, psychiatrists and other professionals; it must have sufficient numbers of patients to maintain their specialized skills and must provide safe and high quality care (14). Advanced critical care and diagnostic imaging, as well as costly technological equipment are also needed to support neurosurgery (15). This paper highlights the establishment of new self-sustaining neurosurgical facilities in the less developed parts of West Africa

**Historical and Socio-Cultural Context**

The University of Benin Teaching Hospital (UBTH) is a located in Benin City, in the middle of southern part of the country and is the confluence of several interstate highways linking all the geopolitical zones of Nigeria. Commissioned in 1973 as a 280-bed facility, it grew by 2010 into a 700-bed multispecialty tertiary hospital, 40% of that growth taking place between 2004 and 2010 under the leadership of Prof. E.E. Okpere. In November 2007, 18 months after the inception of neurosurgery in Benin City, a 30-bed neurosurgical ward was included (5, 13). It serves a population of 10-12 million spread over at least three states. It is the major referral centre for all cases of central nervous system trauma, congenital anomalies, tumours, vascular and degenerative disorders in this zone.

By 2006, the nearest other tertiary hospitals with versatile neurosurgical services were, at least, 300 kilometers away in Ibadan and Lagos - the latter had the privilege of most of the few and unevenly distributed neurosurgeons in the country, as well as the better established facilities. For decades, neurosurgical patients from this region were admitted in hospitals far from home with its socioeconomic implications to both patient and caregiver who were faced with daunting road travels on unsafe highways to another specialist facility hoping for bed space on arrival there.

Within the health community itself, there were several negative perceptions with respect to neurosurgery. Also, craniotomy and skull traction, were seen as unnecessary afflictions to patients “who would die anyway”. Many considered that the surgeries took too long and required too much blood; thus, no theatre nurses readily volunteered to assist or were willing to participate. The ward rounds were tedious as they involved almost every hospital ward as neurosurgical patients were located anywhere within the hospital where there was a free bed. Instructions and medical orders were poorly understood in the first few months.

## **AIM**

This purpose of this paper is to provide documentation on the establishment of a dedicated neurosurgical service within a tertiary institution in West Africa.

## **MATERIALS AND METHODS**

We reviewed the hospital/institutional records with particular emphasis on a) acquisition of building- wards and operating room, b) staffing - medical staff, nursing and ancillary staff, c) acquisition of neurosurgical equipment- including operating room equipment and diagnostic equipment, d) commencement of neurosurgical procedures, e) academic programs f) collaborations.

## **RESULTS**

In June 2006, neurosurgical in-patient admission in U.B.T.H., Benin City began with two beds in a twenty-four bed general surgical ward which also admitted plastic, orthopaedic, urologic and otolaryngologic patients. Neurosurgical Ward Facility (Figure 1) The neurosurgical ward facility commenced with the use of emergency room trolleys as ward beds. Like most hospitals in West Africa, our hospital had several buildings left for many years at various stages of non-completion due to frequent changes of leadership. The hospital management at this time embarked on the completion of the thirty-year old storey building which became the (initially 60-bed, two-floor) neurosurgical facility in November 2007 commissioned formally in January 7, 2008 by the Minister of Health. Due to the dearth of space for surgical specialties, the orthopaedic department initially shared, and later owned, the thirty-bed space ground floor.

The neurosurgical (first) floor also houses call rooms and senior registrars’ office, ward managers and consultant’s offices, nurses’ break and changing rooms, and records and revenue offices. The facility was originally designed, over three decades earlier, with a ramp linking the ground and first floors and the roof (which had a helicopter landing pad never used or maintained) (figure 8) The maintenance of this facility was never left to the hospital management. Painting of the ward, provision of curtains, operating and ward equipment and treatment for indigent patients was often funded by the in-house staff and the unit’s local and foreign affiliates. The provision of an additional thirty-bed neurosurgical in-patient ward (and training of a new set of neurosurgical nurses) to be completed by August 2012 has commenced.

### **Dedicated Neurosurgical Nurses.**

The training of twenty-six (23 ward and 3 operating room (O.R.) neurosurgical nurses commenced in March 2007. The curriculum included basic neuroscience, basic neurology and psychiatry, neurosurgical nursing care, ward ethics and intensive care for approximately nine months. They were drafted to commence the first 30-bed neurosurgical facility on 15th November, 2007. Retraining took place yearly for one month since then. Seven additional nurses (5 for the ward and 2 for the O.R.) were included in the program in 2009 bringing the number to 30. These are the first ever set of neurosurgical nurses to be trained within the country. They were exempted from the nursing departments’ redeployment of nurses to various hospital units without specialisation.

### **Ancillary Staffing**

Occupational therapists (OT) and physical therapists (PT) were included in the neurosurgical team from inception and went along on the ward rounds and were provided with equipped one-room stations each within the neurosurgical ward to ensure availability and proximity to the patients. The OT and PT rooms which were not initially part of the facility were carved out of an open waiting room within the neurosurgical ward. One member of the team is a qualified neuro-occupational therapist. The initial equipment and carpentry in both rooms were designed and funded by the in-house staff using local metal workers and carpenters.

### **Operations and Operating Room Facility.**

Operating room (O.R.) equipment for spinal and intracranial surgeries as well as skull traction were identified from catalogues (size, type and number were tailored to our immediate needs) and ordered from manufacturers in South East Asia. Delivery took three months, but the instruments which cost the hospital just over four thousand dollars are still in use after six years. Our first surgery was performed in October 2006.

At present, surgeries undertaken include: congenital anomalies (spina bifida, hydrocephalus, encephaloceles, craniosynostosis, etc), spinal and brain tumours, pituitary and posterior fossa tumours, central nervous system infections, laminectomies, discectomies and surgeries for intracranial haematomas.

There are two operating rooms and two operating days for elective surgery. Emergency surgeries are performed round the clock. There are two operating microscopes including one portable microscope, a power drill and two computerised tomography (CT) scanners.

We do not have a neuroendoscope or stereotactic frame and the operating table used were those available from inception of the hospital until the Federal government completed the refurbishment of the operating rooms in 2011. A C-arm was also then made available for use during discectomies. By January 2012, 30 to 40 operations were performed monthly compared to 23 operations which were possible in the first six months after inception. Currently, 600 in-patients are admitted yearly. Activities include daily ward rounds, weekly neurosurgical out-patient clinics, catering for 50 or more patients, thrice weekly neurophysiotherapy and neurooccupational therapy clinics.

### **Present Staffing**

Present staffing includes: one neurosurgeon, 32 trained dedicated neurosurgical nurses, one in-house neurooccupational therapist, a team of physical therapists and others. We have five neurosurgical senior registrars, admitted into the programme since July 2008, at various stages of the neurosurgical senior residency: they spend the first year of the neurosurgical senior residency in our unit then proceed to spend two years at the Department of Neurosurgery at the University College Hospital, Ibadan. Three months each are spent in (Neuro)pathology and Neurology. The last one year of neurosurgical rotation is spent at home in our unit to determine their preparedness for final fellowship examinations of the West African College of Surgeons in Neurosurgery.

### **Academic Programmes**

This consists of weekly interdepartmental surgical audit and grand rounds with the department of surgery, weekly neuroradiology conference for neuroscience specialties, weekly neurosurgical/neuroanatomy conferences and neuropathology (brain cut-up ) sessions. To date, a number of publications have emerged from various aspects of our care of the patients and our unit's development. Efforts are presently geared towards obtaining support for collaborative basic science research. The unit's in-patient records, since 2008, are kept on computerised database operated by an in-house staff member employed to handle records. The in-patient records from preceeding years, though with some missing details, are gradually incorporated into the database from previous records in registers. Operation records however are complete. Nurses' retraining takes place for one month every year, during which at least 2 new nurses are trained for the unit.

### **Collaborations**

Much needed ward and operating room equipment have been acquired through our affiliation with the Korle-Bu Neuroscience Foundation (KBNF) and, through them, we also have affiliation with the Korle-Bu Teaching Hospital in Ghana, since 2009. Based in Canada and Ghana with programmes aimed at improving clinical neurosciences and research in West Africa, the KBNF has donated since 2009 operating room and ward equipment to our facility. They also facilitate yearly training for our staff in the form of neuroscience conferences (held in Ghana, Nigeria, Liberia and other West African countries), hands-on operative training with experienced neuroscience nurses, neuroanaesthetists and neurosurgeons from Johns Hopkins Medical centre, Vancouver General Hospital and other parts of North America. Pro-Health International (PHI), a non-profit organization based in Nigeria, that provides free medical care,( including surgery,) to less privileged communities, has facilitated our association and missions with KBNF. In addition, PHI and the Sunny Obazee Foundation for Children with Hydrocephalus have sponsored the treatment of many children with neurosurgical diseases. The Ashanti- Graham Health and Education Initiative Foundation (AGHEIF) based in

the United Kingdom has yearly equipped us with operating room, ward and educational resources. These include power drills, operating microscopes, and educational material, The Federal government completed in 2011, the refurbishing and re-equipment of our hospital with modern operating rooms and intensive care units.

## DISCUSSION

Latunde Odeku pioneered neurosurgery in West Africa in 1962 at University of Ibadan, Nigeria (1,2,3,4). The expected optimum neurosurgeon to population ratio is 1:100,000; currently this stands at 1: 1, 200,000 in Africa, and 1:6.5million in West Africa(7,8,9) In Nigeria presently, there are just over 30 neurosurgeons serving 160 million people (10). In Benin City, Nigeria, one neurosurgeon served 10 to 12 million people. Neurosurgical conditions are a major source of morbidity and mortality, a socio-economic burden impacting negatively on the individual's quality of life, the lives of their caregivers and society (6,16). the major neurosurgical concerns in our predominantly young population are trauma, infections, congenital anomalies and tumours. In various parts of Nigeria, like much else anywhere in Africa, many neurological problems may remain unrecognized, neglected or untreated (12). The greatest scare of most hospital managers concerning the establishment of a neurosurgical facility is the source of sufficient and appropriate resource to support the neurosurgical service (14). However, while great expense may be essential for an established medical faculty, far less is required for a reasonable beginning in any needed sphere of medicine; with necessity and some opportunity, determined efforts and a sense of purpose, much can be readily accomplished with limited resources (12). By and large, the neurosurgical facility is self-sustaining and, with time, generates enough resources on its own, but this is only so where resources are well-channelled and judiciously utilized for patient care and institutional growth; this allows a system of well-defined services to meet the needs of the neurosurgical patient (14).

Many patients still wait long periods for elective surgery - due to inadequate manpower and facility, including bed space - and emergency surgeries may not take place at optimum times due to the long wait for shared operation room facilities to be available. Consequently, some patients are still referred for safe, timely, effective and efficient intervention such as stereotactic, radiosurgical and functional neurosurgical procedures (12,14) The key contribution of the neurosurgical unit is in broadening the scope of medical students and the training of resident doctors and nurses, whose training in the past was at huge costs at other tertiary facilities as supernumerary staff (12). Also, by its presence, it draws awareness to salient features of neurosurgical disease and indicates that neurosurgical lesions, as perceived, are not untreatable conditions (12).

Overall neurosurgical mortality, by 2009 in our centre was 13.5%, especially high with respect to ICU admissions, severe traumatic brain injury, elderly patients, intracranial abscesses and brain tumours; operative mortality was 6% (17,18). In similar settings, Emejulu reported an overall neurosurgical mortality of 13.9% (2009) while Odeku reported an operative mortality of 10.4% (1962) (11,12).

## CONCLUSION

A functioning, and still expanding, neurosurgical unit with trained specialist neurosurgical nurses, physical and occupational therapists serving over 10million people has been established at our teaching hospital facility. Similar units can be established in other resource-limited situations in West Africa.

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The immense contribution of Prof. Okpere whose astute leadership and management team encouraged the establishment of a functioning neurosurgical unit in Benin, the Korle-Bu Neurosciences Foundation, Ashanti-Graham Health and Education Initiative Foundation (AGHEIF), Pro-Health International, Sunny Obazee Fund for children with Hydrocephalus and all others who gave so much, are duly acknowledged.

**Conflicts of interest: None**



**Figure 1**  
The Neurosurgical In-Patient Complex completed in November 2007



**Figure 2**  
Trained Neurosurgical Nurses in the Neurosurgical Ward



**Figure 3**  
In-House Neuro-Physiotherapy Team



**Figure 4**  
Neurosurgical Operating Room



**Figure 5**  
Ramp for conveying patients between floors of the complex.



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