# A Prospective Emergency Department–Based Study of Pattern and Outcome of Neurologic and Neurosurgical Diseases in Haiti

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■ OBJECTIVE: **To perform the first prospective survey of neurologic and neurosurgical emergency department (ED) admissions in Haiti.**

■ METHODS: **Data of all ED admissions at 3 Haitian hospitals for 90 consecutive days per site were collected prospectively. Patients who were given a diagnosis of a neurologic or neurosurgical disorder by the ED physician were entered in a deidentified database including demographics, presenting symptoms, brain imaging (when available), requests for neurosurgical consultation, and outcome.**

■ RESULTS: **Of the 7628 patients admitted to the ED during this study, 1243 patients had a neurologic disorder, yielding an ED-based neurologic disease prevalence of 16%. The 3 most common neurologic diseases were cerebrovascular disease (31%), neurotrauma (28%), and altered mental status (12%). Neurosurgical pathologies represented 19% of all neurologic admissions with a combined ED-based disease prevalence of 3%. Mortality rate was 9%. The most common neurosurgical disease was neurotrauma (87%), caused by motor vehicle accidents (59%), falls (20%), and assault (17%). Neurosurgical procedures were performed in 14 of 208 patients with a mortality rate of 33%.**

■ CONCLUSIONS: **This prospective survey represents the first study of neurosurgical or neurologic disease patterns in Haiti. The results suggest specific disease priorities for this population that can guide efforts to improve Haitian health care and conduct more comprehensive epidemiologic studies in Haiti.**

Even before the 2010 catastrophic earthquake and cholera epidemic, Haiti was the poorest and most pathologically burdened nation in the Western Hemisphere (1, 9, 34). Given such challenges, the surgical and medical management of neurologic disease in Haiti is likely to be suboptimal. Documentation of these diseases is poor, leaving many unanswered questions about Haitian disease patterns. To address adequately the medical needs of developing countries such as Haiti, it is imperative to define the local epidemiology (21).

Recognizing the growing awareness of the importance of nervous system disorders in the global burden of disease, the field of global neurosurgery seeks to identify and help address what is needed by applying the tools of public health to neurosurgical disorders (11, 13, 17, 31, 35). The aim of this study is to perform the first prospective survey of neurologic and neurosurgical emergency department (ED) admissions at 3 major Haitian hospitals to determine the disease patterns and outcome in these fields.

## METHODS

### Ethical Clearance

Ethical approval was obtained by the institutional review board of the Icahn School of Medicine at Mount Sinai, New York, New York, and by each of the 3 Haitian institutions participating in this research project.

**Key words**
- Brain injuries
- Cerebrovascular disorders
- Global health
- Haiti
- Neurologic diseases
- Neurosurgical procedures
- Outcome assessment

**Abbreviations and Acronyms**
**CDC**: Centers for Disease Control and Prevention
**CT**: Computed tomography
**CVD**: Cerebrovascular disease
**ED**: Emergency department
**HBM**: Hospital Bernard Mevs Project Medishare
**HUEH**: Hôpital de L'Université d'État d'Haïti
**MVA**: Motor vehicle accidents
**TBI**: Traumatic brain injury
**WHO**: World Health Organization

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### Data Collection and Sites

For this prospective study, on-site data of all ED admissions for 9 months at 3 Haitian hospitals for the period August 2012 through May 2013 were collected. The 3 participating hospitals were Hospital Bernard Mevs Project Medishare (HBM), Hôpital de L'Université d'État d'Haïti (HUEH), and Hôpital Albert Schweitzer. These sites were selected to compare data from the only hospital with a computed tomography (CT) scanner (HBM) with another urban site without a CT scanner (HUEH) and with a rural hospital (Hôpital Albert Schweitzer).

HBM is a 50-bed trauma, critical care, and rehabilitation hospital in Port-au-Prince that was the only hospital with a working CT scanner and neurosurgery capabilities on site after the earthquake in 2010. Neurosurgery accounts for 10% of total surgical interventions performed at the hospital, with emphasis on elective treatment of hydrocephalus performed by local and visiting volunteer neurosurgeons (7, 18).

HUEH is a 700-bed university hospital in Port-au-Prince. It remains the country's largest tertiary care center despite the fact that it was significantly damaged by the 2010 earthquake. It treats >169,000 patients annually (23, 32).

Hôpital Albert Schweitzer is located in the rural region of Artibonite in Deschapelles. It has a 130-bed capacity for inpatients and observation and serves a population of >340,000 individuals living in the surrounding mountains of central Haiti. There is no neurosurgical service at this hospital (12, 28).

### Definitions and Data Entry

All ED admissions were recorded. Patients given a diagnosis of a neurologic or neurosurgical disorder by the ED physician were entered in a deidentified database that included demographics, presenting symptoms, brain imaging (when available), and requests for neurosurgical consultation at sites with neurosurgical capacity. Each patient's outcome, with or without neurosurgical intervention until discharge from the hospital, was also recorded.

### Neurologic Disease Categories

Patients with diagnoses of neurologic disorders were divided into the following categories.

***Altered Mental Status.*** All patients presenting with confusion, disorientation, or signs of depressed consciousness or receiving a diagnosis of "altered mental status" were placed in this category. Patients with seizure, infection, or signs of cerebrovascular disease (CVD), such as stroke or malignant hypertension, were excluded from this group.

***Brain Tumors.*** Patients with a diagnosis of tumor of the brain or spine were placed in this category.

***Cerebrovascular.*** Patients with a diagnosis of stroke or subarachnoid hemorrhage or presenting with malignant hypertension associated with headache, altered mental status, or neurologic deficit were placed in this category.

***Congenital Anomalies.*** Pediatric patients presenting with hydrocephalus, spina bifida, or encephalocele or pediatric patients for whom the cause of admission was a nervous system anomaly were placed in this category.

***Headache.*** Patients receiving a diagnosis of "headache" or "migraine" and without malignant hypertension were placed in this category.

***Meningitis or Central Nervous System Infection.*** All patients with a diagnosis of meningitis confirmed by lumbar cerebrospinal fluid analysis and patients with altered mental status or neurologic deficit caused by abscesses or other infection of the central nervous system were placed in this category. Patients presenting with seizure were excluded.

***Neurologic Deficit.*** Patients presenting with nontraumatic focal neurologic deficit, such as unilateral weakness or bilateral extremity paralysis, but who were not given a diagnosis of either CVD or infection were placed in this category.

***Neurotrauma.*** Traumatic injury caused by external force applied to the skull, spine, or central nervous system was classified as neurotrauma. Lacerations to the scalp with no loss of consciousness or other sign of injury to the skull or brain did not count as neurotrauma. For patients with head trauma, a Glasgow Coma Scale (GCS) score was recorded in all cases in which the attending physician or surgeon assigned a GCS score to the patient.

***Neurosurgical Disease.*** All neurologic patients for whom the attending physician requested a neurosurgical consultation, regardless of whether an intervention was performed, were categorized as having "neurosurgical disease."

***Peripheral Nervous System Disorders.*** Patients with a diagnosis of "neck pain," "back pain," or neuropathy of the extremities in the absence of trauma, focal neurologic deficit, or other neurologic symptoms were placed in this category.

***Seizure.*** All patients presenting with seizure or receiving an initial diagnosis of "seizure" or "epilepsy" were placed into this category. Patients from this group whose final diagnosis might otherwise fit into another category, such as "meningitis," were retained in the "seizure" category.

### Statistical Analysis

Data were analyzed with one-way analysis of variance using StatPlus:mac LE:2009 (AnalystSoft, Inc., Vancouver, British Columbia, Canada) or Student unpaired t test using Microsoft Excel for Mac 2011 (Microsoft Corporation, Redmond, Washington, USA), as indicated, and are presented as mean ± standard deviation. A probability value $<0.05$ was considered significant.

## RESULTS

During this study, 7628 patients were admitted to the ED. Of 7628 patients, 1243 had a neurologic disorder, yielding an ED-based neurologic disease prevalence of 16% (**Table 1**). The most common categories of neurologic disease observed at the 3 sites were CVD (388 cases; 31%), neurotrauma (353 cases; 28%) and altered mental status (151 cases; 12%) (**Figure 1A**), with a significantly higher volume of CVD observed at HUEH (**Figure 1B**). Differences in disease pattern were not statistically significant among hospitals for the other categories.