

Increasing Neurosurgical Self-Sufficiency in Sub-Saharan Africa

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Introduction

In Tanzania, there are 4 neurosurgeons for 46 million people. To address this shortage, we collaborated with the Tanzanian government to develop a train-forward program for sustainable, self-propagating neurosurgery in resource-poor settings. The program utilizes intensive hands-on, one-to-one, bedside teaching, with local health workers trained to perform neurosurgical procedures independently and then trained to train others. This report quantifies increasing self-sufficiency with increasing case complexity over 6 years.

Methods

The program was introduced in 2006 at a remote, rural hospital in northern Tanzania. Outcome information was collected retrospectively from hospital records for the period 2005-2010. De-identified data was analyzed for changes in number and complexity of procedures, degree of Tanzanian independence, and impact on post-surgical complications.

Surgery was considered “**independent**” if performed by a Tanzanian alone or with a Tanzanian trainer.

Case “**complexity**” was categorized as:

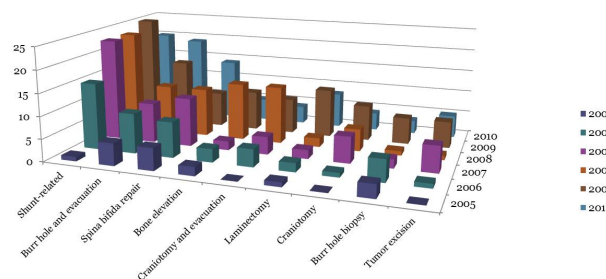
- **Simple** (ventricular drain, exploratory burr holes or burr holes for evacuation of epidural or subdural hemorrhage, traumatic head wound repair without skull fractures)
- **Complex** (shunt placement/revision, burr holes for tumor biopsy, craniotomies, myelomeningocele or encephalocele repair, spinal decompressions, discectomy, fusions)
- **Moderate** (other)

Results

By 2010, three generations of Tanzanian health care workers had been trained which resulted in:

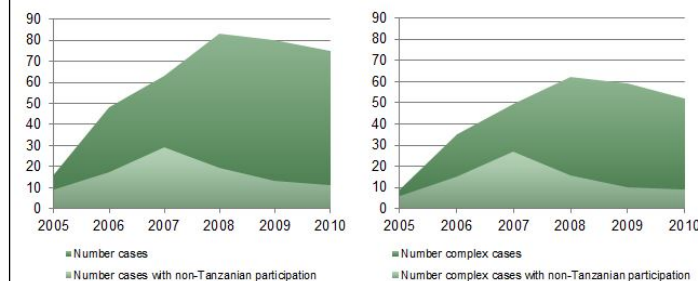
- The number of procedures performed increasing from 18 in 2005 to an average of 95 per year in the last 3 years.
- Independence increasing significantly from 44% in 2005 to 86% in 2010 ($p < 0.001$).
- The number of complex cases performed independently also increasing from 34% to 83% ($p < 0.001$).
- Patients who were admitted as training progressed being 29% less likely to experience post-operative complications (multivariable odds ratio 0.71, $p = 0.03$).
- A decrease in post-operative complications that was more pronounced (48%) when restricted to pediatric patients (≤ 17 years).

Most Common Procedures by Year



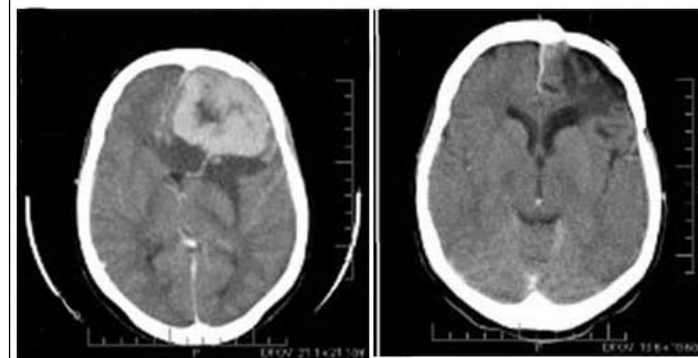
Most Common Procedures by year, beginning the year before program implementation.

Total Cases vs. Complex Cases



Increase in total number of cases (left) & complex cases (right) performed, as well as the total number of cases (left) & complex cases (right) performed independently by Tanzanian health care providers.

CT Scans of Brain Tumor Removed Independently by a Tanzanian Trainee



(Left) Preoperative CT scan revealing a large left frontal enhancing mass. (Right) 2 years postoperative CT scan with minimal residual tumor.

