



Customer Success Story | Acuo by Hyland

# Michigan State University

## VNA Helps in Fight against Childhood Cerebral Malaria

Acuo by Hyland allows Michigan State University researchers and clinicians on multiple continents to collaborate on pediatric medical images in an effort to increase survival rates in children with cerebral malaria.

MSU Department of Radiology uses the Acuo Vendor Neutral Archive (VNA) to support clinical research in Malawi aimed at understanding malaria-induced brain swelling in pediatric patients. Acuo by Hyland manages MRI studies and routes them from the Malawi imaging center to the MSU campus and other global locations. The software's image-sharing capabilities enable better collaboration between Malawi radiologists, U.S.-based researchers, specialists, surgeons and clinical experts, resulting in new treatment options for affected patients.

### Challenge

#### Autopsies provide limited insight into brain trauma

According to the World Health Organization (WHO), there were an estimated 438,000 malaria deaths worldwide in 2015. Cerebral malaria accounts for the vast majority of these deaths and its victims are most commonly children under the age of five living in sub-Saharan Africa. Dr. Terrie Taylor, medical professor at Michigan State University, is an internationally recognized scientist and physician that has spent six months a year for the past 30 years in the African nation of Malawi researching this deadly disease and treating its patients. Her team has made some major breakthroughs in understanding cerebral malaria thanks, in large part, to a magnetic resonance imaging (MRI) machine donated to Queen Elizabeth Hospital in Blantyre and VNA technology. Using these tools, she and her colleagues discovered that children infected with cerebral malaria are likely to be dying from complications of massive brain swelling.

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#### CUSTOMER

Michigan State University (MSU)  
Department of Radiology in  
East Lansing, MI/Queen Elizabeth  
Hospital in Blantyre, Malawi

#### FOCUS

Clinical research

#### PRODUCTS IN USE:

Acuo by Hyland

*Photo Above: Jim Peck, Communications and Brand Strategy, Michigan State University*

**Acuo**  
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**Although medical imaging is widely available throughout the developed world, the Malawi MRI facility was among the first public MRI facilities in sub-Saharan Africa and the only MR scanner within the borders of Malawi.**

“We are using MRI to define the very highest risk group of patients,” Taylor said. “The etiology of the swelling remains mysterious to us. The swollen brain gets forced down out of the skull and it compresses the patient’s respiratory center. In essence, the patient stops breathing, but the heartbeat continues if respiratory support (bag-and-mask ventilation) is provided. There are three or four potential causes and we are working to sort out the relative contributions of each.”

Although medical imaging is widely available throughout the developed world, the Malawi MRI facility was among the first public MRI facilities in sub-Saharan Africa and the only MR scanner within the borders of Malawi. Prior to the use of MRI, Dr. Taylor and her team relied on patient autopsies as the primary means of exploring malarial effects on the brains of pediatric patients. Autopsy results confirmed brain swelling, but characteristics of the herniation process that would cause death weren’t present.

“We quickly realized there was an important limitation to the autopsies,” Taylor said. “They only provided information following the moment of death. We had no idea what preceded it, and we had no way of knowing which, if any, of the autopsy findings were features of the disease in survivors.”

It became apparent that neuroimaging technology would be necessary to collect and study images of the brain at different intervals, and to compare findings in survivors to those in fatal cases to truly understand the deadly progression of cerebral malaria. With MR scanning capability established in Malawi, the research team began imaging patients and quickly saw the radiologic evidence of the brain being forced down through the foramen magnum, causing death.

This wasn’t recognized during the autopsies because when the top of the skull was removed to examine the brain, the pressure was released, and the evidence of herniation was no longer apparent.

While enthusiastic about these findings, the research team realized it couldn’t rely solely on the impressions of a single radiologist. They needed to accumulate, organize and manage images from multiple patients and share these studies with the radiologist in Malawi, and his counterpart in the U.S., to ensure the scientific validity of the work.

The IT challenges to accomplish this were plentiful, including the need to implement data-networking over an intercontinental, satellite-based Internet service while achieving such a feat from within a developing nation. The research program required an IT solution that could perform daily routing of lossless-compressed Digital Imaging and Communications in Medicine (DICOM) MR studies in a timely manner from Malawi to MSU and other global sites for clinical research interpretation, quantitative post-processing and archiving.

### **Solution**

#### **VNA supports global image sharing in a third-world country**

Fortunately, the MSU Clinical Center already used the Acuo VNA from Hyland Healthcare to support the storage, management and transmission of MR image data locally and was able to extend this solution to meet the global image exchange requirements of this important research effort. Doing so, however, was no small task.

## Collaboration on MRI results helped Dr. Taylor and her global colleagues gather critical details regarding the brain swelling pattern in children with cerebral malaria.

Matt Latourette, research assistant with MSU's Department of Radiology, had to overcome substantial technical challenges associated with setting up an intercontinental network in a developing country. Those challenges included a variety of logistical, political, and regulatory complications; limited local technical resources; and human resource protection complexities—all further complicated by travel burdens and time-zone differences. When the VNA solution was first implemented in Malawi, satellite-based transmission of the images was the only available option. Since that time, Matt's team has converted to an optical-fiber Internet connection.

In spite of these challenges, imaging studies performed on the MR scanner are being managed efficiently by the Acuo VNA, which functions as DICOM image storage, automatically forwarding images to a standalone image-viewing workstation for primary diagnostic reading at the Malawi MRI facility and performing queued image transmissions to MSU. Acuo VNA software deployed at both Malawi and MSU manages the end-to-end, encrypted and compressed data transmission. The VNA applies configured rules to select studies for transmission to specific destinations. It caches, encrypts and queues studies to exchange DICOM images with the remote DICOM router using a proprietary routed network protocol.

Using Acuo VNA software, Latourette is able to collect and manage all medical images from Malawi patients at MSU. The onsite radiologist in Malawi and other local clinicians also receive images electronically via the Acuo DICOM router.

“Everything imaged on the MR scanner is distributed via the Acuo VNA routing software to the local DICOM workstation in Malawi as well as the server here at MSU,” Latourette said. “We can now easily retrieve studies whenever we need them for clinical research.”

According to Latourette, the system is in frequent use by clinicians who view images with the support of the Malawi radiology technician. “Everyone now knows exactly how to find their images,” Latourette said. “The images are also used for teaching. We have MSU medical students doing rotations in Malawi that see patients in the research ward and then view the patient images on the DICOM workstation.”

Latourette estimates there are approximately 20 different groups of clinicians and medical students/residents who use the workstation each day to view images. “The Acuo VNA software is the backbone of our medical imaging network,” Latourette said. “It gets images efficiently and securely to where they need to be. Clinicians can easily and intuitively find the imaging information they need to treat patients. Acuo also works well with all the other vendor software involved in our patient care process.”

### Results

#### **Sharing neuroimages leads to breakthroughs in cerebral malaria treatment**

Collaboration on MRI results helped Dr. Taylor and her global colleagues gather critical details regarding the brain swelling pattern in children with cerebral malaria. Children whose brains swelled dramatically and irreversibly — died. Children whose brains did

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- Matt Latourette, Research Assistant, MSU Department of Radiology

not swell — or swelled, but then returned to a normal size — lived. This discovery suggests the potential for alternative therapy approaches that focus on the swelling, rather than on the parasite that causes the disease. Reduction in the number of deaths from cerebral malaria may be achieved through an ancillary treatment that does not attack the infection, but the response of the brain, including drugs that reduce brain swelling, surgery to relieve pressure in the skull, or the use of ventilators to breathe for the patients until brain swelling goes down naturally. Dr. Taylor’s study of these and other potential treatments is ongoing and clinical trials to test some of these approaches are set to begin in the coming months.

The ultimate goal of Dr. Taylor’s team is to reduce the mortality rate of cerebral malaria patients from 38

percent to zero. Acuo VNA technology is helping to put this goal within reach. “The image management capabilities of the Acuo VNA software have been invaluable to our research and to clinical care more broadly at the hospital,” Taylor said. “The ability to easily share images supports our process of using independent radiologists working in various global locations to access the images remotely, interpret them and record the results. I can’t imagine being able to do this work in a timely manner without the global image-sharing capabilities of the Acuo VNA. It lets us easily involve other experts intellectually on an international scale to try and make a difference in the lives of our young patients.”

MSU welcomes the assistance of individuals and corporations in this ongoing research effort.

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