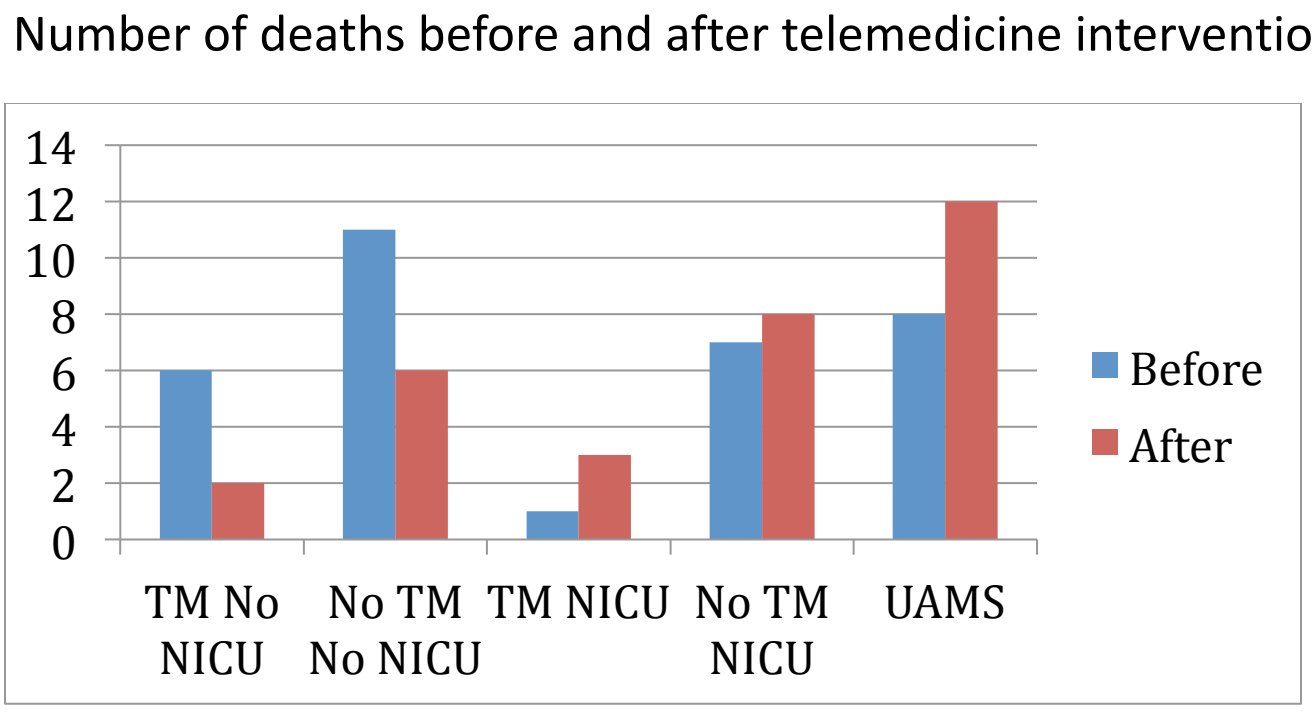
ARKANSAS COBRE
Center for Translational Neuroscience
University of Arkansas for Medical Sciences, Little Rock

What have we done lately?

1. We lowered the death rate among low birth weight babies in the State

Decreasing Infant Mortality through telemedicine

Preterm birth is a major cause of infant mortality, contributing about 40% to the infant death rate. While survival of these vulnerable neonates has increased along with the development of newer technologies, many babies die because they were delivered in smaller hospitals not equipped to care for these fragile infants. For the past 30 years, it has been known that regionalization of perinatal care improves the outcomes of this fragile population, but despite the known benefits, regionalization has been applied sporadically. Telemedicine, the remote diagnosis and treatment of patients via electronic communication, offers a novel way to improve the outcome of high-risk pregnancies. Preliminary data from our Center over a very short period of time, 9 months, has shown that telemedicine, through the PedsPLACE (Pediatric Physician Learning and Collaborative) program can lead to lower neonatal mortality, likely as a result of improved regionalization of perinatal care. This project determines the effects of telecommunication on infant mortality in Arkansas, a rural state with high infant mortality. We also study the barriers to regionalization through chart review and the effects of telemedicine on perinatal regionalization. This program, if successful, can be implemented in any state and most countries with the political will to reduce infant mortality. This represents a unique opportunity to save lives AND decrease health care costs.

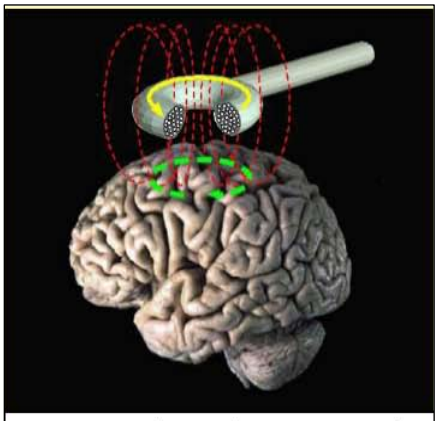


TM represents telemedicine; UAMS represents University Hospital. Note the decline in mortality in TM equipped hospitals without a NICU.

We should also note that we have reduced the number of intraventricular hemorrhages in the State by 5 per year, representing a savings of $1.5 million per year.

2. We developed a novel treatment for Tinnitus (ringing in the ears)

We use a technique called transcranial magnetic stimulation (TMS) to treat a condition known as tinnitus (ringing in the ears). Tinnitus is the false perception of sound such as ringing, buzzing, hissing. Tinnitus *affects 50 million adults in the US; twelve million seek treatment and 3 million are disabled. There is no cure for tinnitus. In fact, no clinically available treatment actually reduces tinnitus perception. TMS is a noninvasive device that delivers magnetic pulses over the scalp which activate neurons in the brain (see figure). We have used financial support to the Center for Translational Neuroscience COBRE from NIH-NCRR funds to show that TMS can reduce the loudness of tinnitus in 50% of patients and that the benefit of one treatment can last several weeks. Additionally, we have pioneered a new method of delivering TMS, maintenance therapy, which uses regularly scheduled TMS treatments to achieve long lasting treatment benefit.*



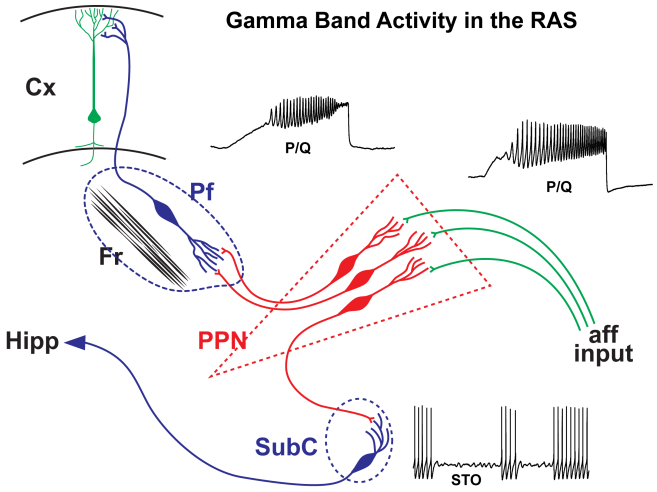
During TMS, electrical currents passed though a coil of wires create a magnetic field over the scalp that activates neurons in the brain.

or

3. We discovered a new sleep-wake mechanism

Area deep in the brain generates activity related to consciousness and dreaming.

When we are awake with our eyes closed, electrodes on the scalp measure waves of human brain activity at 10 Hertz (Hz), or 10 per second. If we fall asleep, these waves slow to 6-8 Hertz during drowsiness and light sleep, and then to 2-4 Hz in deep sleep. When we open our eyes, are alerted and pay attention, our brains begin to fire at 20-40 Hz. These waves are called "gamma band activity", and are present during consciousness and learning, and also during dreaming. Dogma was that "gamma band activity" was only present in the cerebral cortex, the thin, convoluted surface of the brain. Recently, investigators found "gamma band activity" in other parts of the brain, such as the hippocampus and cerebellum. Scientists at the Center for Translational Neuroscience at UAMS have discovered that parts of the reticular activating system, the part of the brain that controls sleep, dreaming and waking, exhibit "gamma band activity". In fact, nerve cells in this area prefer to fire at ~40 Hz when stimulated. This means that the reticular activating system activates the rest of the brain when we are alerted, and it does so, not by triggering such activity in other regions, but by itself inducing "gamma band activity". This process thus recruits waking or dreaming. This novel mechanism may allow the development of new stimulants and anesthetics that can modulate this brain rhythm.



4. We developed two new treatments for spinal cord injury

Currently, there are 10,000-12,000 spinal cord injuries (SCI) that occur in the United States yearly. The cause of the increased reflexes as well as spasms that occur following SCI are not clearly understood. The development of increased tone and spasms limit the functional independence that a patient is able to achieve. Our Center has examined two treatments, passive exercise, motorized bicycle exercise training (MBET), of the lower extremities and a pharmacologic intervention, oral Modafinil (MOD). Our studies showed that MBET of the hindlimbs for 30 days in an animal model of SCI leads to normalization of hyper-reflexia. Our work has also demonstrated in an animal model that MOD normalized the exaggerated reflexes that were induced by the SCI. We established that MBET could be translated into a successful treatment for a patient with a SCI. We developed a device for SCI victims and demonstrated that 8-10 weeks of MBET normalized exaggerated reflexes. The human MBET allows a patient to exercise daily from their wheelchair without additional transfers or difficulty with positioning that would prohibit regular exercise. The potential use of MOD, a stimulant with low abuse potential that is already approved for the treatment of daytime sleepiness due to narcolepsy and obstructive sleep apnea, is being explored as an additional therapy in the treatment of spasticity for human SCI.