THE HARTWELL FOUNDATION

2011 Individual Biomedical Research Award

Review of Proposed Research

Investigator: **Elizabeth A. Hunt, MD, M.P.H., Ph.D.**
Assistant Professor
Departments of Anesthesiology & Critical Care Medicine and Pediatrics

Institution: **The Johns Hopkins University**

Proposal: **Advancing and Optimizing Quality of Resuscitation In Children with Cardiac Arrest**

Over 4,000 children per year will suffer a cardiac arrest requiring at least 2 minutes of chest compressions and most will not survive regardless of where the event occurs. It is a tragedy that a child will die because a team of clinicians repeatedly pause their compressions, stopping the flow of blood to the heart and brain but unaware of the fatal mistake they are making. In the pediatric intensive-care setting there is one cardiac arrest per 100 admissions and the survival-to-discharge rate for children following in-hospital cardiac arrest is a meager 27%. It was only a few years ago that *smart* defibrillators (capable of measuring attributes of resuscitation) provided the first insight into the problem indicating that the quality of resuscitation delivered both in and out-of-hospitals was poor. Rate and depth of chest compressions were often incorrect, the number and rate of ventilations were frequently overzealous and harmful, and the overall length of pauses during cardiac arrests excessively long. Fortunately, it is now possible to identify deficiencies in resuscitation practices using evidence based evaluation. Today, life-like anatomical human models are available as high-fidelity patient simulators to provide realistic palpable pulses, mimic changing blood pressure, exhibit visual chest rise and fall, produce detectable cardiac rhythms, and can be intubated and defibrillated. The use of computer control in such devices permits them to be programmed to permit evaluation of cardiac arrest scenarios from different causes and thus identify most effective modes of operation and best training practices for using defibrillators. Unfortunately, even though Johns Hopkins in 2011 became one of the first hospitals in the world to use smart defibrillators on children, their use has not resulted in improved survival. Betsy's preliminary data from observing both real and simulated cardiac arrests suggests this is related to critical defibrillator design flaws: particularly in the poor quality of dynamic feedback provided to users. Variable and inconsistent display of information from existing smart defibrillators provides a source of confusion that contributes to operator error. To address this unmet need, she proposes to identify usability performance barriers of smart defibrillators during simulated pediatric cardiac arrest events using widely accepted high-fidelity patient simulators and objective recording of user response to output from the defibrillators. If successful, existing deficiencies in the machine-user interface for smart defibrillator technology will be improved, enabling and informing healthcare workers eager to optimize their performance in an effort to save the lives of children with cardiac arrest.