Introduction:
Lowering intracranial pressure to improve brain perfusion during CPR has become a focus for our team. Combined with devices that enhance venous return out of the brain and into the thorax during CPR, outcomes have improved using head/chest elevation in the laboratory (Fig. 1). This study’s purpose was to confirm the safety/clinical feasibility of this new approach involving mechanical CPR at an angle.

Methods:
2,285 consecutive out-of-hospital cardiac arrest (OOHCA) cases (all rhythms) were studied for 3.5 years (1/1/14 to 30/6/17) in an expansive, socio-economically-diverse U.S. county (pop. 1.4 mill). In 2014, EMS crews used the Lucas© and impedance threshold (ITD) devices on such patients, but, after April 2015, they also: 1) applied O2 and deferred +/-pressure ventilation several min; 2) raised the backboard ~20°; and 3) solidified a pit-crew approach to expedite Lucas© placement. Neuro-intact survival was not recorded until 2015, so resuscitation by EMS to hospital admission was used for consistency. Quarterly reports were run to identify any periodic variations or incremental effects during protocol transition (Quarter 2, 2015).

Results:
No problems were observed with head/torso-up positioning (n=1,319), but rates of resuscitation rose steadily during the transition period with an ensuing sustained doubling (Fig. 2) over the ensuing 2 years when compared to those studied (n=806) prior to the head-up approach (mean 35.2%; range 30-40% vs. 17.9%, range 15-20%; p < 0.0001). Outcomes improved across subgroups. Response intervals, indications for attempting CPR and bystander CPR rates were unchanged. Resuscitation rates in 2015-17 remained proportional to neuro-intact survival.

Conclusion:
The head/torso-up CPR bundle was not only feasible, but also associated with an immediate, steady rise in resuscitation rates during the transition phase with a sustained doubling of resuscitation rates, making a compelling case that this bundled technique may improve OOHCA outcomes in future clinical trials.

Image 1:

![Image 1](Laboratory Studies Leading to Concept of Improved Cerebral Perfusion Pressures with Head-Up CPR)

Image 2:
Immediate and Sustained Doubling of Resuscitation by EMS after Introducing the Novel Approach to CPR