Challenges:
Ensure end-to-end safety and effectiveness of patient care under distributed and mobile environment:

- Executable pathophysiology and best practice models
- Dynamic patient condition monitoring in ambulance under limited and variable bandwidth
- Design verifiable medical guideline models
- Specify, validate and trace assumptions in system design and evolution
- Requirements and Safety Engineering in Medical CPS
- Clinical evaluations for transitioning research results into medical practices

Solutions:

- Organ-centric best practice guideline system (UIUC)
- Pathophysiological model-driven communication (UIUC)
- Clinical validation with Carle and OHSU medical center on high-impact diseases, e.g. sepsis and heart failure (UIUC)
- End-to-end traceability from clinical and system requirements, safety analysis, to design and implementation (UIUC)
- Verifiable and validatable statecharts for disease and treatment models (IIT)
- Statechart model patterns for modeling medical guidelines (IIT)
- Modeling and integrating assumption models with medical cyber-physical system design (IIT)
- We are in the process of extending and integrating two team solutions towards distributed mobile environment (UIUC & IIT)

Scientific Impact:
- Computational pathophysiology [1]
- Bayesian network for early sepsis detection[2]
- Mental workload reduction system designs for medical staff [3]
- Pathophysiology-driven and bandwidth-compliant communication protocols [4]
- Verifiable medical guideline models [5][6]
- Statechart model patterns [6][7]
- Physical environment assumption management [8]

Broader Impact:
- The project improves emergency care for people in rural areas.
- The validated and verified system will serve at central and southern Illinois with 1.2 million people.
- Successful pre-clinical evaluations are recommended for clinical trial.
- The cardiac arrest guidance system is submitted to FDA for the (pre-)approval process.