CPS: TTP Option: Synergy: Collaborative Research: An Executable Distributed Medical Best Practice Guidance (EMBG) System for End-to-End Emergency Care from Rural to Regional Center

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Project Details

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Abstract: In the United States, there is still a great disparity in medical care and most profoundly for emergency care, where limited facilities and remote location play a central role. Based on the Wessels Living History Farm report, the doctor to patient ratio in the United States is 30 to 10,000 in large metropolitan areas, only 5 to 10,000 in most rural areas; and the highest death rates are often found in the most rural counties. For emergency patient care, time to definitive treatment is critical. However, deciding the most effective care for an acute patient requires knowledge and experience. Though medical best practice guidelines exist and are in hospital handbooks, they are often lengthy and difficult to apply clinically. The challenges are exaggerated for doctors in rural areas and emergency medical technicians (EMT) during patient transport. This project's solution to transform emergency care at rural hospitals is to use innovative CPS technologies to help hospitals to improve their adherence to medical best practice. The key to assist medical staff with different levels of experience and skills to adhere to medical best practice is to transform required processes described in medical texts to an executable, adaptive, and distributed medical best practice guidance (EMBG) system. Compared to the computerized sepsis best practice protocol, the EMBG system faces a much bigger challenge as it has to adapt the best practice across rural hospitals, ambulances and center hospitals with different levels of staff expertise and equipment capabilities. Using a Global Positioning System analogy, a GPS leads drivers with different route familiarity to their destination through an optimal route based on the drivers' preferences, the EMBG system leads medical personnel to follow

the best medical guideline path to provide emergency care and minimize the time to definitive treatment for acute patients. The project makes the following contributions: 1) The codification of complex medical knowledge is an important advancement in knowledge capture and representation; 2) Pathophysiological model driven communication in high speed ambulance advances life critical communication technology; and 3) Reduced complexity software architectures designed for formal verification bridges the gap between formal method research and system engineering.

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