Project Title: Medical and Casualty Estimation in Counter-Insurgency Operations

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This project is a collaborative research effort of the Center for Integrated Healthcare Delivery Systems at Penn State, the Center for Operations Research in Medicine and Healthcare at Georgia Tech, the Network Science Center at West Point, and the Center for AMEDD Strategic Studies at the U.S. Army Medical Department Center & School. Furthermore, this research is funded by the National Science Foundation Graduate Research Fellowship Program.

Overview:
Estimation of casualties likely to be incurred during combat military operations, especially counter-insurgency (COIN) operations, are essential for accurate assessments of healthcare personnel and other medical resources required to support those operations. Medical resource planning for an effective Health Service Support (HSS) system requires accurate forecast of casualty incidence rates for killed-in-action (KIA), wounded-in-action (WIA), captured mission-in-action (CMIA), and disease and non-battle injuries (DNBI), along with admission rates for WIA and DNBI.

Within the military medical community, we have been trained to think of casualties as a result of state-on-state conflict. Although this was predominantly true through the end of the Vietnam War, for the near and mid-term our risk will remain with insurgent and terrorist groups for whom the traditional methods of casualty prediction have little or no applicability.

We must radically reorient our approach to casualty estimation in today's COIN operations in order to improve the Army's HSS system. Specifically, we aim to revamp the older techniques used to estimate casualties in conventional operations by critically analyzing the data on terrorist and insurgent organizations collected by various intelligence, surveillance, and reconnaissance (ISR) assets for clues in determining important quantifiable, independent variables (cultural, socio-political, economic) for casualty estimation.

Objective:
Develop a decision support model for medical and casualty estimation in COIN operations that outputs accurate casualty estimates, patient streams, and medical resource estimates.

Approach:
1. Develop a database of casualty, medical evacuation, and medical resource usage data from past and current COIN operations (primary data from OIF / OEF / OND).
2. Identify key attributes (injury types, mechanisms of injury, etc.) from COIN operations in order to determine appropriate model inputs and outputs.
3. Establish a system dynamics model and social network of COIN operations in order to create a methodology for transforming qualitative data from ISR assets into quantifiable, independent variables.
4. Perform predictive analysis (Bayesian, simulation, support vector machine, classification tree, etc.) to identify critical discriminatory attributes for casualty estimation.
5. Create decision support model that determines optimal HSS system resources required for rapid recovery and medical treatment of casualties in COIN operations.
6. Perform model validation & verification and conduct sensitivity analyses using our findings for decision support model refinement.

Impacts:
This research seeks to provide Army medical planners with an accurate medical and casualty estimation model for counter-insurgency operations to assist in determining the optimal medical resources necessary to effectively bolster the Army’s Health Service Support system.