**AI Based Opioid Overdose Prevention**

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Opioid addiction in the United States has come to national attention as opioid overdose (OD) related deaths have risen at alarming rates, yet not enough is known about the epidemiology of OD to stop the rise, neither a quantitative approach to predict the risks of patients at individual level. Combating opioid epidemic becomes a high priority for the governments, local communities and healthcare providers. This depends on critical knowledge to answer following questions: 1) Which regions or communities have high risk of OD? And 2) What patients are of high risk of OD? Our goal is to develop innovative methods and software to identify communities and patients at high risk and provide decision support for both the government and healthcare providers.

We propose to take a large scale, multi-level data driven study to understand OD by integrating multiple data sources, mining such data to find patterns and communities of high risks through high resolution spatial-temporal analytics, and building AI driven prediction models to predict OD risk of a patient at individual level from a patient's history of electronic health records. We will first perform state-level retrospective study by analyzing NYS SPARCS data, with all patient visits and claims information for 15 years to discover spatial-temporal patterns of OD (both heroin and non-heroin based), and predict the mortality risks of OD patients at community level, e.g., zip code or census tract level. We will perform retrospective study by using comprehensive Electronic Health Records of patients with opioid use history from Stony Brook University Hospital (SBUH) from 2013-2018. We will build deep learning based prediction models to predict OD risks of patients through a temporal deep learning model using integrated EHR data, including patient demography, diagnoses, prescriptions, procedures, history, and clinical notes.

The work will be built upon our extensive experiences on integrative big spatial data driven public health studies, scalable software for big spatial big data analytics and geocoding, clinical natural language processing, and machine learning. Our interdisciplinary team includes a computer scientist (Wang) on machine learning and geospatial data mining, clinical faculty (Rosenthal) with expertise on addiction for clinical guidelines and evaluation, biostatistician (Hou) on statistical analysis, epidemiologist (Schoenfeld) on public health methodologies and outreach.

The long term goal of this research is to build an evidence and AI driven approach for opioid epidemic research through building integrative spatial-temporal analytical methods and deep learning based predictive models, to identify communities for interventions, and to improve clinical decision support. In addition, we aim to reach out to local communities for interventions and preventions. We also aim to engage research community to build a nationwide data driven opioid epidemic research community.