

## **Health Services Delivery in Context: Modelling Spatial and Contextual Patterns of Distribution and Utilization through Integration of Big Data and Organizational Behavior and Factors**

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This position paper is in response to the NSF-CDI and NSF-IBSS Project - 2015 Joint Summer Specialist Meeting theme, “*Representing Human Dynamics with Big Data, Social Media, and Social Networks.*” The integration of big data with applicable use in health services is growing exponentially as we continue to bridge methodological and structural barriers. This paper will discuss general themes related to health service delivery and the development of big data/contextual approaches to the study of hospital networks, interaction, and performance with the goal of improving health.

The Patient Protection and Affordable Care Act (PPACA, 2010) is one of the most revolutionary pieces of legislation since the Medicaid and Medicare Acts of the 1960s. It is revolutionary in that it hinges on the collection and utilization of population and patient data to determine its success, distribution, and ultimately, failure, if it fails to use that massive amount of data unwisely. The most exciting aspect of big data is the potential to use information to go beyond descriptive statistics and consolidation of likelihood ratios and odds ratios and move into high-frequency dynamic predictive models that can complement existing research and facilitate knowledge in an era of growing data demands that characterize our complex health services delivery system.

Within this complexity consideration of organizational characteristics, the hubs of service distribution, and their relationship to their environment and the services they deliver are striking. Our understanding of the role of hospitals in population health continues to grow as we seek to synergize patient care with population health, both in policy and quality. Hospitals and more broadly, the health services delivery system, can no longer operate in a silo and must be responsive to the population it serves, both healthy and not. The PPACA in conjunction with other legislation has driven the big data movement in health services by funneling money into modernizing our records system and pushing for adoption of Electronic Health Records (EHR/EMR) as well as the emphasis of not just collecting data but also turning into information and knowledge that can improve health outcomes.

### *Big Data and Hospital Interaction*

Health disparities and organizational attributes have been studied widely and much is known about the care delivered within individual hospitals. What is not as widely studied is how each hospital's activities, including services, structure, and outcomes are interacting with their populations, also termed catchment or service areas, and with other hospitals in a health services context. This is the role that big data can play in that we have information available for each organization, we have it for the population surrounding the hospital, and we have the locations of each area. The efforts of

continuing this research are to move in a direction where these areas of effect are studied as integrated entities, attributes that flow together in patterns that can help us understand where resources are being over-utilized, populations are not being served, all with the goal of improving patient outcomes and population health while also maximizing the utility of available resources.

Some of the areas that will be covered by this research area include health service referral patterns, hospital and health services network distribution and variation, resource allocation and competition, and ultimately the use of population based data to detect hospital performance patterns to improve quality. These big data efforts include the use of social media to measure interaction, satisfaction, and performance from the patients' and population perspective as well as the mapping of referral networks to measure equity and population health services. Data and text mining are potential application especially with respect to social media that compare decision trees, neural networks, and regression models to predict patterns of use that benefit population health.