Managing patients with complex, chronic disease is the largest challenge facing modern healthcare, with the “perfect storm” of increasing prevalence and high costs in economic terms as well as clinical outcomes. The number of patients with advanced liver disease continues to grow in the VA system and in the general US population. In 2008, the prevalence of chronic liver disease in the US reached 15%. Complications of cirrhosis frequently require hospital admission, and each year cirrhosis is responsible for >150k admissions at a cost of approximately $4 billion. Among patients who survive their initial hospitalization, nearly half are rehospitalized within 1 year. This pattern is similar to other complex diseases with acute exacerbations requiring hospitalization, such as congestive heart failure, COPD, and end-stage renal disease. This has particular relevance for the VA, which has a disproportionate share of patients with complex, chronic diseases, e.g., cirrhosis prevalence among HCV patients is estimated to exceed 50% over the next decade.

The VA faces both tremendous opportunities and challenges in designing the next-generation electronic health record to provide state-of-the-art user interfaces for clinical care no longer weighed down by a single patient focus and paper record workflow legacies. Dashboards are a representational informatics tool that can be used to support decisions about a population of patients. Dashboards display groups of patients based on relevant clinical characteristics and allow clinicians to stratify, filter, and order by outcome or performance measurement rates that are relevant to that subpopulation. However, they have been slow to enter clinical practice because of sophisticated underlying data requirements and only a recent broad acknowledgement of the complex human factors engineering that is required to safely and effectively implement health information technology to optimize workflow and support improvements in clinical care.

In this proposal, we will develop and evaluate a framework to manage information flow and support decisions of patients with advanced liver disease throughout the care continuum (i.e., both outpatient and inpatient care). Relevant information will be extracted from structured and unstructured electronic data using advanced natural language processing (NLP) techniques. This information will be used to identify at-risk patients and in predictive models to provide risk stratification. Each patient’s risk and associated clinical recommendations based on best evidence will be presented through a population- and patient-level visualization tool containing decision support. The Dashboard will be created using best-practice human factors engineering. The goal of this project is to create a platform that will directly impact and improve the clinical care that Veterans’ with chronic disease receive. The Specific Aims of this study are:

**Specific Aim 1:** **Development of Near Real-Time NLP Tools for Case Finding and Clinical Information Extraction Associated with Mortality and Admission among Cirrhotic Patients*.*** We will develop an integrated NLP pipeline to augment structured data case finding for patients with cirrhosis as well as extract modifiable risk factors for mortality, admission, and readmission that may be amenable to clinical intervention. *We hypothesize that the proposed NLP pipeline can extract, in near real-time, cirrhosis for case finding and risk factors for mortality, admission, and readmission among cirrhotic patients with a target precision and recall performance of 0.90 for both case finding and risk factor extraction.*

***Specific Aim 2: Development of Risk Models for Mortality, Admission and Re-admission among Cirrhotic Patients.*** We will use the combination of structured and processed unstructured data to develop prediction models for mortality, admission, and re-admission. The models will include modifiable risk factors that will allow risk stratification and tailored clinical interventions to reduce risk among those modifiable risk factors during the admission and discharge windows.

*We hypothesize that risk models among ALD patients for mortality and admission among outpatients and mortality and re-admission among inpatients can be developed with good discrimination and adequate calibration for internal and external model validations.*

**Specific Aim 3:** ***Development of an Advanced Liver Disease Clinical Dashboard.*** We will develop an integrated clinical dashboard to both: 1) detect and manage patients with cirrhosis to provide recommendations and facilitate the receipt of evidence-based Quality Indicators, and 2) identify those at high-risk for mortality, admission, and re-admission to optimize their inpatient and outpatient clinical care. An iterative user centered design cycle will be used to develop the clinical Dashboard: 1) Identify and specify the functional tasks relevant to users; 2) Assess Dashboard usability using progressively higher fidelity prototypes, use cases, and clinical simulations; and 3) Structure validation to evaluate whether the tool performs its intended functions.

**Specific Aim 4:** ***Evaluation of an Advanced Liver Disease Clinical Dashboard***. We will perform a pilot evaluation at the Nashville and San Diego facilities to evaluate the clinical effectiveness and real world usability of the clinical dashboard developed in Aim 3. *We hypothesize that a clinical dashboard for the management of patients with cirrhosis will improve the proportion of receiving all applicable evidence-based quality indicators compared to usual care.*