Health Information and Informatics: The Heart of the Matter “The Devil is in the Details”
Jennifer Garvin, PhD, MBA, RHIA, CPHQ, CCS. CTR, FAHIMA

**Introduction:** The use of health information and informatics can provide better data, improve care, and assist research in the clinical domain of heart failure in the Department of Veterans Affairs (VA). For example, ejection fraction, evidence of guideline-direct medical therapy, and reasons for not prescribing medications, such as contraindications can be obtained using natural language processing (NLP) and information extraction (IE). We can also use this data in decision support with existing functionality of the VA electronic health record, CPRS. We also used cognitive task analysis and formative evaluation based on several theoretic frameworks and models to design a clinical reminder to prompt beta blocker titration in primary care.

**Methods:** In our development of NLP and IE we targeted the concepts of left ventricular systolic function (LVSF) assessment and ejection fraction (EF), angiotensin-converting enzyme (ACE) inhibitor, angiotensin receptor blocker (ARB), and beta blocker (BB) therapy for appropriate patients, and reasons why patients may not be on medications. We constructed and tested automated algorithms to transform unstructured data within text into structured data representing these concepts. We partnered with clinicians to develop needed decision support and to identify the delivery mechanism of this support using Cognitive Task Analysis (CTA) and Usability Assessment (UA). We undertook qualitative interviews to assess the clinical content and acceptability of design of the prototype.

**Results:** We completed the extension of an existing NLP system and found the following performance metrics: for ejection fraction extraction, recall of 96.7%; precision of 97%; and F1-measure of 96.85. For extraction of medications we found: recall of 97.9%; precision of 99%; and F1-measure of 98.5%. In terms of reasons why the providers did not prescribe beta blocker medications we found: recall of 86.2%; precision of 84.7%; and F1-measure of 85.5%. These results indicate good performance with respect to algorithmically identifying the relevant data needed for the decision support tool using NLP. The concepts we extracted are comparable to concepts found in the Unified Medical Language System (UMLS) and biomedical ontologies. While a mapping of the concepts we extracted to external knowledge bases is beyond the scope of funded proposal, mapping of concepts with subsequent output from CHIEF could be accomplished with additional funding. Two rounds of UA evaluations with providers were conducted (4 were undertaken remotely with 9 completed on-site with VISN-12 providers). The preliminary results confirm that our clinical reminder provides patient-specific clinical information that providers find useful and needed when considering a CHF patient for Beta Blocker titration. The patient-specific clinical information provided includes blood pressure, weight trends, and important contraindications. The feedback indicates that the prototype facilitates the assessment for Beta Blocker titration, and guideline-informed care.

**Conclusions:** IE and NLP can be used to accurately extract relevant data for patients with heart failure which can be useful for patient care and research.