Putting the EHR to Work:

A BIG DATA APPROACH TO CLINICAL DECISION SUPPORT
Key Points

- Grand Round Table (GRT) has developed the Clinical Assistant, a clinical decision support application integrated into the electronic health record (EHR) which links providers to relevant clinical resources at the point-of-care.
- A study of the software’s diagnostic performance at a leading Philadelphia teaching hospital found that the software’s recommendations improved overall coverage of final diagnoses by 25% when added to the normal diagnostic workflow of physicians.
- A survey of resident physician perspectives established the software’s ease of use, value in clinical workflow, and providers’ expectation that such software will become the standard of care in the years ahead.

Overview

Modern medicine faces two major challenges that stand out both for their difficulties and the opportunities they present. The first is the ever-increasing amount of information that health care providers must learn and apply in clinical practice. Over the past fifty years, an explosion of clinical knowledge has led to ever more complex and impressive clinical applications.1-3 However, health care providers are unable to keep up with the pace of innovation under the current educational models that train and provide updated clinical information.4-6 The second challenge is the growing cost of providing health care, which is currently $3 trillion, and is expected to grow to $4.8 trillion by 2021 at this rate.6 One way to alleviate rising costs is to develop solutions that deliver more efficient care particularly to the 1/4 of Americans suffering from multiple chronic conditions that account for roughly 2/3 of healthcare spending.7,8

The recent, widespread adoption of electronic health records (EHR) provides an opportunity to addresses these obstinate challenges of increasing knowledge and cost in healthcare by using the latest big data approaches to automatically connect healthcare providers at the point-of-care with the right clinical information at the right time.

“...the right clinical information at the right time.”
The Clinical Assistant from Grand Round Table is an innovative clinical decision support solution integrated with the Electronic Health Record (EHR) that does exactly that. At the click of a button, the Clinical Assistant uses the information that clinicians have already entered about their patients’ recent encounters and test results in the EHR to generate a deidentified clinical profile. The Clinical Assistant then delivers distilled insights to the point-of-care via a secure web portal by pattern matching that profile against a database of millions of evidence-based clinical resources including the most current, relevant clinical guidelines, articles, and case studies to the clinical situation that they are actually facing saving clinicians the time and aggravation of digging for answers to clinical questions.

The Clinical Assistant is poised not only to save clinicians time but also save hospitals resources wasted trying solutions that don’t work to get multiple chronic conditions the care they need. These individuals tend to be on multiple medications simultaneously, have an extensive medical history, and their conditions interact with one another making diagnosis and management particularly challenging and time consuming for providers. Part of the problem is that medical resources are decentralized for these patients. By automatically centralizing resources for providers relevant to the clinical challenges they face in caring for these patients, the Clinical Assistant has the potential to supporting providers in streamlining care to provide the best care at lower cost.
1. Study Objective and Methods

The Clinical Assistant filters clinical resources for undiagnosed patients by generating a list of possible diagnoses. In order to assess the quality of this critical feature, we compared the diagnostic performance of the Clinical Assistant to that of a group of physicians on challenging, real life cases. The study was conducted at Einstein Medical Center, a leading teaching hospital in Philadelphia. We evaluated the software during the Morning Report clinical conference where doctors discuss challenging cases from the previous week as a learning exercise.

At Morning Report, each challenging case was presented in stages based on the actual unfolding of clinical observations from the clinic. At the end of each stage, the physicians at Morning Report collectively drafted a list of possible diagnoses, called the differential, based only on the clinical information revealed about the patient up to that stage. For our study, we compared the diagnostic performance after the initial stage which included information such as patient demographics, chief complaint, past medical history, review of systems, and basic lab results. We deemed this early stage in the case to be a good benchmark because possible diagnoses were always collected during Morning Report at this stage and diagnostic judgments in this early stage influence future clinical judgments. Meanwhile, clinical information was simultaneously entered into the Clinical Assistant which independently generated a list of ten possible diagnoses. We determined a list to be accurate if it included the final diagnosis.

The Clinical Assistant was present at Morning Report twice weekly over several months, and was evaluated for a total of 13 challenging cases with a confirmed final diagnosis. A group of 15-20 physicians consisting of medical residents, two to three chief residents, and one to two attending physicians provided the differential for each case.

A secondary objective of the study was to evaluate user perspectives on the Clinical Assistant. During the clinical decision support evaluation process, residents were surveyed on the educational experience of using Clinical Assistant, whether they would use it in their clinical workflow, and whether this type of software would become a part of standard clinical practice.
2. Summary Results

We found that given the same clinical findings from only the initial patient workup, both Morning Report physicians and the Clinical Assistant independently provided the correct final diagnosis in 64% of cases. Although the diagnostic performance was comparable overall, the groups correctly identified the final diagnosis for different sets of cases. This means that for some challenging cases, the Clinical Assistant performed better than the group of physicians at Morning Report. In fact, the physicians in attendance missed a-third of the diagnoses in this early stage that the Clinical Assistant correctly identified.

When recommendations from the Clinical Assistant were added to their diagnostic workflow, overall coverage of the final diagnosis improved by 25%. This finding is important because it demonstrates the synergistic value of the Clinical Assistant when combined with the medical knowledge and experience of healthcare professionals.

The surveys of the residents also generated intriguing findings. Sixty-six percent (66%) of residents reported that the Clinical Assistant enhanced their educational experience. This is an important finding as not only does GRT generate diagnoses that the healthcare professional might have not considered but also links users to relevant clinical guidelines, articles, and case studies pertinent to their specific patient. Looking ahead, 75% of residents stated that they would use the Clinical Assistant software regularly if it was in their clinical workflow and 80% reported that clinical decision support solutions like GRT will become standard practice. These findings illustrate that healthcare providers recognize both the ease of use of the Clinical Assistant and the value it provides in the context of patient care.

This study marks only the beginning of our efforts to explore the value of the Clinical Assistant. We believe that with the impressive performance of the Clinical Assistant in this model academic setting, there is even greater potential to impact care in primary care settings where care is increasingly delivered under serious time and resource constraints.

“75% of residents stated that they would use Clinical Assistant software regularly if it was in their clinical workflow”
In future studies, we plan to assess the software on much larger patient populations. We are starting this process by running the Clinical Assistant on past cases that we extract from historical claims data.

3. Behind the Scenes

The Clinical Assistant is powered by our proprietary, Big Data engine that uses the latest in machine learning technology to pattern match the presenting patient against a database of millions of clinical resources including 20 million deidentified insurance patient claims provided by Independence Blue Cross, 8 million clinical abstracts from PubMed, and additional medical references. The breadth of the clinical engine’s coverage allows the Clinical Assistant to deliver insights that healthcare professionals may not have considered.

A key aspect of our technology development process is our commitment to quality by continuously testing the engine on clinical vignettes and other clinical resources known to identify certain diagnoses targeted opportunities for improvement.

The confusion matrix figure (right) illustrates this continuous testing process for acute abdominal pain diagnoses. The y-axis represents the actual diagnosis label for the medical abstracts and clinical vignettes being tested, and the x-axis represents the diagnosis predicted by the Clinical Assistant for the same set of documents. The spectrum of colors (blue to red) corresponds to the percent of documents given each label by the Clinical Assistant (0 to 100). Areas where the true label and the predicted label match the same diagnosis signals that performance is good, and areas where there is discrepancy are areas for improvement.

For some chief complaints, the Clinical Assistant achieves up to 70% accuracy identifying the correct diagnosis using up to 200,000 medical abstracts and clinical vignettes at a time.
As we are able to fill in gaps by training the engine on the clinical data that we can identify is needed, this technique allows the engine to cover more and more diagnoses with greater accuracy over time.

4. Key Features

Light Integration for Simple Installation
GRT’s clinical solution is designed with light integration for easy installation. This allows users, whether in the inpatient or outpatient setting, to quickly and effortlessly apply the software in the context of the EHR that they already use.

Extracts Clinical Findings from Free-form Text
The Clinical Assistant automatically extracts clinical information from the electronic health record entered into both structured fields, such as checkboxes, and as free-form text, such as text boxes. This feature is critical in uncovering key clinical findings buried in pathology and imaging reports in the patient’s medical history.

Interprets Lab Results
Abnormal lab results are automatically extracted and converted to the clinical finding that they represent.

Recognizes Negation
The Clinical Assistant smartly differentiates between clinical findings that are commonly recorded in the EHR as “NOT abnormal” from the ones that are actually abnormal.

Poised to Fulfill Meaningful Use 3 Criteria
Stage 3 of the Meaningful Use Criteria for Electronic Medical Records is slated to be implemented in the coming years, and as early as 2016. These new criteria are focused on improving patient outcomes through clinical decision support and improving quality and efficiency. GRT’s clinical decision support software is well-positioned to fulfill these criteria and early adopters may be able to avoid penalties and quality for incentive payments administered by CMS.
5. Time and Monetary Savings

One of the exciting aspects of GRT’s clinical decision support software is its potential to save healthcare providers time and money. The software supports healthcare professionals in working up patients and reaching a final diagnosis in less time. In the United States, efforts to establish a diagnosis account for about 10 percent of all medical costs, or $250 billion per year. GRT could help healthcare professionals to expend less resources on diagnosis. In addition, as GRT’s clinical decision support software helps clinicians to more accurately diagnose patients and links to relevant management resources it could help to reduce the time needed to direct patients into proper management “swim lanes”. This could decrease unnecessary testing and time spent in the ED or as hospital inpatients. Further investigation to explore the potential benefits of GRT’s clinical decision support software is needed but it is likely that the software will help clinicians to more efficiently diagnose patients and direct them to the care they need.
Conclusion

This white paper serves to report on the high diagnostic accuracy of GRT’s clinical decision support software, especially when applied synergistically with a healthcare professional’s clinical expertise. In addition, it presents resident physicians survey results that establish both the software’s ease of use and that healthcare professionals recognize the software’s value and expect it to become the standard of care in the years ahead.

GRT’s clinical decision support software uses the latest in Big Data and machine learning to enable healthcare professionals to deliver the latest patient-centered care.

The software has the potential to save time and money by reducing unnecessary testing and time to diagnosis to more efficiently manage patients in both an inpatient and outpatient setting. In addition, the software may help healthcare professionals to fulfill Meaningful Use 3 criteria by providing decision support and by improving quality and efficiency, potentially leading to improved health outcomes.
References
