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**Clinical Quality Hearing**  
**HIT Standards and Policy Committees**

- Views expressed are those of the presenter/author (Dr. Goldstein) and not necessarily those of the Department of Veterans Affairs.
- To address the needs of today's complex patients, many of whom have multiple co-existing illnesses (often known as "Multiple Chronic Conditions" or "Multimorbidity") it is essential to have sophisticated forms of clinical decision support (CDS) that can take account of multiple factors within a patient's clinical data, and can apply knowledge across multiple disease states.
- One approach to this is to encode detailed clinical knowledge into computable formats, using knowledge acquisition systems that can be readily reviewed by clinical experts, and then to link the encoded clinical knowledge with detailed patient data for processing by an execution engine that can draw conclusions about the state of the patient and also make individualized recommendations for next steps in clinical management. The 2004 JAMIA paper cited below includes details about one such system.
- Encoding clinical knowledge from clinical practice guidelines often reveals gaps and ambiguities in the guidelines. In order to make the guidelines actionable both for clinicians and for CDS systems, it would be desirable for the appropriate source of authority, that is, the guideline authoring group, to make the decisions about precise definitions of terms as they are used within each guideline. For example, guidelines often use general terms ("diabetes") but in order to identify the correct patient from electronic medical record data it is essential to define which patients with diabetes are meant in that particular context, and to express this definition in terms that are used for coding electronic health record patient data.
- Automated systems have the potential to bring detailed clinical knowledge to clinicians at the point-of-care, individualized to the patient being seen at that time. Any new automation also introduces the possibility of new forms of error as unintended adverse effects. Accordingly, it is essential that systems undergo offline testing prior to fielding to check for errors in the recommendations generated; furthermore, since there can be errors that are rarely occurring and may not be detected in testing prior to deployment, CDS systems should also be subject to ongoing monitoring and evaluation during use (which we call "post-fielding surveillance").
- A CDS system that incorporates complex clinical conditions and criteria can be used not only to provide advisories (recommendations) to clinicians, but can also be used to develop more advanced forms of performance measurement. Performance measures are often limited by the limited data systems available in the past; with electronic health record detailed data, it is possible to develop new performance measures that can take account of more of the patient's clinical data and can be computed in an automated fashion so that rather than doing performance measurement on a sample of patients it can potentially be done on all or most patient data. Simple performance measures as currently used, without taking account of complexity of patients, often make one of 2 choices, both undesirable: on the one hand, they may include all patients with a target condition in the denominator, recognizing that the performance in the numerator is not actually applicable for a substantial number of the patients based on their comorbidities; or, it may use a more refined denominator to select a group of patients with a much higher likelihood of being appropriate for the numerator performance but at the cost of not having anything to say about the rest of the patients with that condition. Newer systems that encode detailed clinical knowledge can take account of many more patient factors and so open the door to more nuanced performance measures which are likely to reflect better quality patient care.

I'd like to use a few papers that are available in full-text on pubmedcentral via the links below (includes citations):

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC516243/?tool=pmcentrez>

14.

[Translating Research into Practice: Organizational Issues in Implementing Automated Decision Support for Hypertension in Three Medical Centers](#)

Mary K. Goldstein, Robert W. Coleman, Samson W. Tu, Ravi D. Shankar, Martin J. O'Connor, Mark A. Musen, Susana B. Martins, Philip W. Lavori, Michael G. Shlipak, Eugene Oddone, Aneel A. Advani, Parisa Gholami, Brian B. Hoffman

J Am Med Inform Assoc. 2004 Sep-Oct; 11(5): 368–376. doi: 10.1197/jamia.M1534

PMCID: PMC516243

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1480350/?tool=pmcentrez>

33.

[The effects of CPOE on ICU workflow: an observational study](#)

CH Cheng, MK Goldstein, E Geller, RE Levitt

AMIA Annu Symp Proc. 2003; 2003: 150–154.

PMCID: PMC1480350

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1839659/?tool=pmcentrez>

11.

[Task Analysis of Writing Hospital Admission Orders: Evidence of a Problem-Based Approach](#)

Christopher D. Johnson, Roni F. Zeiger, Amar K. Das, Mary K. Goldstein

AMIA Annu Symp Proc. 2006; 2006: 389–393.

PMCID: PMC1839659

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1839712/?tool=pmcentrez>

[Identifying Barriers to Hypertension Guideline Adherence Using Clinician Feedback at the Point of Care](#)

N.D. Lin, S.B. Martins, A.S. Chan, R.W. Coleman, H.B. Bosworth, E.Z.

Oddone, R.D. Shankar, M.A. Musen, B.B. Hoffman, M.K. Goldstein

AMIA Annu Symp Proc. 2006; 2006: 494498.

PMCID: PMC1839712

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1839611/?tool=pmcentrez>

5.

[Offline Testing of the ATHENA Hypertension Decision Support System Knowledge Base to Improve the Accuracy of Recommendations](#)

S.B. Martins, S. Lai, S. Tu, R. Shankar, S.N. Hastings, B.B. Hoffman, N.

DiPilla, M.K. Goldstein

AMIA Annu Symp Proc. 2006; 2006: 539543.

PMCID: PMC1839611