NLP-informed CDS

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NLP-informed Care-Process Improvement (including CDS)

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Goal

100% Process
The Crisis of American Healthcare

McGlynn (2003) The Quality of Healthcare Delivered to Adults
Proven Care Open-Heart Surgery

HIT-Supported Process Re-Design

HIT-Supported Process Re-Design

Alert Fatigue - definition

Decision Support provided to people who are not committed to 100% processes.
Health IT in the Absence of Commitment to 100% Processes

• Expensive, burdensome mistake

• Unlikely to improve quality, efficiency, or satisfaction.
HIT in the Service of 100% Processes

- Indispensable infrastructure.
Care-Process Improvement & CDS

• Improve health.
  – [Improve non-care determinants. 90%]
  – Improve care processes.
    • Support shared patient & clinician sense making.
    • Support patient & clinician knowledge acquisition.
    • Support shared decision making.
    • Translate decisions into cost-effective processes.
      – Proactively embed decisions in care processes. (CDS?)
    • Improve care-process reliability.
Current Use of NLP for Care-Process Improvement

• Care-process reliability (in “process-real time”*)
  – “Reduce time from abnormal mammogram to biopsy and from positive biopsy to treatment.”
  – Use NLP to find positives (in absence of “flag”).
  – Analytics done; process re-design underway.
  – Next: AAAs, pulmonary nodules, ovarian cysts

• Not point-of-care yet.

*Process-Real Time – rapidly enough to optimize care processes and patient outcomes
Current Use of NLP
Possible Use Cases

• Every patient with any noted mammographic abnormality seen in Breast Clinic?
• Every mammogram with any noted abnormality reviewed by Breast Clinic?
• Only patients with clinically significant mammographic abnormality seen in Breast Clinic?

*Process-Real Time – rapidly enough to optimize care processes and patient outcomes
Current NLP-informed Care-Process Improvement

Clinical Decision into BPM → NLP + BPM → BPM → 100% Process
Why Not Point-of-Care?

• Why point-of-care?
  – We are moving as much care as possible away from the traditional (expensive, inconvenient, rushed) POC.
  – Networked PHR makes non-POC usable and useful.

• Aggregation of complete information takes time.

• Robust analysis requires a decision engine outside the EHR.

• EHR users (rightly) demand sub-second screen flips.

• Suggestive NLP can be confirmed.
New, Acute Low-Back Pain (GIGO)

• Common, Painful, Morbid, Expensive
• Over-tested, over-treated (benign)
  – No imaging helpful.
  – Pain meds as needed
  – Bed rest: 14 days >> 7 >> 2 >> Activity as tolerated
  – 90% well in 4 weeks
• Under-tested, under-treated (malignant)
  – 96% chance of metastatic cancer >> bed-bound for life
  – Emergency MRI
  – Emergency X-Ray Therapy consult
• 16 criteria differentiate benign and malignant reliably.
• NLP? The 16 never gets recorded.
(Future) NLP at the Point of Care

- Human or NLP identifies Low-Back Pain.
- NLP can find no prior LBP (or a human identifies it as new).
- NLP finds only 4 of the Deyo 16 in the EHR.
- BPM offers a template with 4 completed & 12 blank.
- Humans (e.g., patient, nurse and doctor) complete the 12.
- CDS calculates diagnosis, prognosis, and plan (order set).
- Doctor and patient negotiate the diagnosis and plan.
- BPM puts diagnosis, prognosis, and plan in the after-visit summary.
- BPM sends patient questionnaires at 2 and 21 days (symptoms; drug adverse effects and adherence; exercises).
NLP-informed Care-Process Improvement (CDS)

*Including documentation and reporting of assessment, decision, performance, and outcome
Questions

• To what extent can NLP mitigate the effects of sub-optimal
  – information-creation support?
  – information-documentation support?

• When information-creation and information-documentation support are optimized, what will the role of NLP be?
  – Exploration for new knowledge?
What Level of Automation Can NLP Support? Now, Soon?

• Full Automation
  – Criteria: highly specific AND negligible adverse effect of error
    • Specificity > 99%? > current criterion standard? > current actual practice?
  – Ex: Abnormal mammo with no record of patient notification

• Partial (Human-mediated) Automation
  – Criteria: lower specificity OR non-negligible risk
    • Sensitivity > ?
    • Specificity > ?
  – Ex: “Does this patient have new, acute low-back pain?”
    • Sensitivity > 95%, Specificity > 90%?
Levels of Automation

- The system activates a protocol
  - without notifying a human.
  - and notifies a human.
  - and allows a human limited time to veto it.
  - contingent on a human’s approval.
- The system suggests one action among many options for human approval.
- The system narrows the options for action to a few.
- The system offers a full set of reasonable options.
- The system presents data clearly, but offers no other assistance.

Structured Data Entry

The limited role of NLP and unstructured text in medical diagnosis:

it is unclear that accurate medical diagnosis/advice mandates front-end NLP technology: structured data entry with thesaurus/N-gram assisted pick-lists or word/phrase completion might suffice.