Diagnostic Errors, Health Information Technology and Payment Reform: the Perfect Storm

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DISCLOSURE

In the past 12 months, I have not had any significant financial interest or other relationship with the manufacturers of the products or providers of the services that will be discussed in my presentation.
Overview 1

• Unique alignment of three trends/forces for change:
  1. Need to improve the diagnostic process and reduce diagnostic errors.
  2. Ongoing scientific revolution that includes new diagnostic technologies as well as advances in health information technology.
  3. Tremendous interest in new advanced payment models (APMs) that improve health care quality while reducing cost.

• Little effort to develop new Diagnostic Advanced Payment Models (DAPMs) that prioritize the first two trends.
  – The current payment system can be a barrier to improved diagnosis.
Overview 2

• This talk will focus on the opportunities in developing and proposing new DAPMs to fill this gap.
  – Briefly describe:
    • The current state of diagnostic errors.
    • The ongoing scientific revolution in diagnosis.
  – Summarize the current environment for the development of advanced payment models (APMs).
    • Review a possible 1\textsuperscript{st} generation DAPM.
    • Propose more sophisticated 2\textsuperscript{nd} generation DAPMs based on rare diseases and complex patients.

• This sounds hard so why do this now? Someone else will.
Diagnostic Errors

• Widely accepted that there are significant inefficiencies and errors in the diagnostic process.

• Landmark 2015 Institute of Medicine report “Improving Diagnosis in Health Care”:
  – Documented concerning diagnostic error rates.
  – Made many recommendations to improve the process.
IOM Report’s First Recommendation

• Recommendation 1a: In recognition that the diagnostic process is a dynamic team-based activity, health care organizations should ensure that health care professionals have the appropriate knowledge, skills, resources, and support to engage in teamwork in the diagnostic process. To accomplish this, they should facilitate and support:
  – Intra- and interprofessional teamwork in the diagnostic process.
  – Collaboration among pathologists, radiologists, other diagnosticians, and treating health care professionals to improve diagnostic testing processes.

• The justification for new DAPMs already exist!
HIT and Scientific Revolution 1

- Health Information Technology
  - EHRs used as the central clinical care information system.
    - Issues with burden and poor implementation.
    - Interoperability remains problematic although field is evolving.
  - Large clinical databases have developed and keep expanding.
- New Diagnostic Modalities
  - Not just NGS and WSI but consider cell phone data and wearables (i.e. data that originates in the patients’ environment).
HIT and Scientific Revolution 2

• Machine Learning/Artificial Intelligence
  – Enables the discovery of previously unknown relationships and knowledge.
  – Raises very significant issues of validation.
    • Requires access to high quality data that is representative of the pathology under study.
    • This is not easily done under the current system.
  – May have complex effects regarding diagnostic accuracy and error
Scientific and Technological Revolution 3

• Pathology and radiology are each well positioned to lead in this effort.
  – Contribute the large majority of structured data.
  – Experience in standards development and implementation.
  – Experience in the issues of clinical communications.
  – Potentially, can collaborate to reduce provider burden associated with the current generation of EHRs.
The need to innovate new payment models resulted in the **Centers for Medicare and Medicaid Innovation** (Affordable Care Act 2011).

- Funded with $10 billion over 10 years. Over $5.6 billion obligated.

The initiative has funded over 100 “models of care.”

Areas for model development have included:

- Accountable Care Organizations
- Bundled Payments for Care Initiative Improvements
- Comprehensive Primary Care Initiative
- Partnerships for Patients Initiative
- Healthcare Innovations Awards
Models that maintain or improve quality while reducing cost can be nationally implemented with the approval of the Actuary of CMS. **No other action is required.**

– To date, according to the CMMI website, 2 of 3 models advanced to the actuary have been certified.

As outlined in the next 2 slides many CMMI models have stressed care coordination and specific diseases.
Health Reform and Payment Models 3

- CMMI Heath Care Innovation Awards for Complex Patients.
  - Adults with mental and developmental disabilities;
  - Children with complex health conditions;
  - Frail elderly with multiple chronic conditions;
  - Patients with late-stage illnesses;
  - Adults with physical disabilities with multiple chronic conditions; and
  - Adults with behavioral problems, mental illness, or cognitive impairment.

- See here for summary of results of 23 studies.
CMMI Disease Specific Heath Care Innovation Awards. 18 awards covering the following disease categories:

- Alzheimer’s disease and dementia
- Cancer
- cardiovascular disease (CVD) and stroke
- chronic pain
- Diabetes
- end-stage renal disease (ESRD)
- pediatric asthma

See here for summary of results of 8 selected studies.
CMMI and PTAC

• The Physician-Focused Payment Model Technical Advisory Committee (PTAC):
  – Created by MACRA in 2015 to encourage the development of APMs referred to as physician-focused payment models (PFPMs).
  – PTAC’s board consists of 11 members that meet publicly on a quarterly schedule.

• Secretary of HHS is **required to respond** to models forwarded by PTAC.
  – Models approved by the Secretary can be forwarded to CMMI for possible future development.
CMMI Results

• It has proven difficult to achieve improvements.
  – GAO reported in May of 2018 that 4 of 37 Advanced Payment Models reduced cost and increased quality.
  – NEJM study Evaluation of Medicare's Bundled Payments Initiative for Medical Conditions: “Hospital participation in five common medical bundles under BPCI was not associated with significant changes in Medicare payments, clinical complexity, length of stay, emergency department use, hospital readmission, or mortality.”
  – We are awaiting the results of the evaluation of the Oncology Care Model.

• A recent review has highlighted the challenges faced by CMMI model developers, and recommendations in the following areas:
  – Iterative testing with market feedback.
  – Realistic time frames.
  – Model Integration.
CMMI Results: Measure Issues

- Must address the issues found in clinical measures.
  - **Time Out - Charting a Path for Improving Performance Measurement:**
    - 63% of physicians report that current quality measures do not capture the quality of the care they provide.
    - Physician practices estimated to spend $15.4 billion annually to report measures.
    - Review of 86 measures relevant for an ambulatory medicine practice on the 2017 QPP list: 37% were vailed, 35% were invalid, and 28% were of uncertain validity.
  - **Relationship of primary care physicians' patient caseload with measurement of quality and cost performance:**
    - “Relatively few primary care physician practices are large enough to reliably measure 10% relative differences in common measures of quality and cost performance among fee-for-service Medicare patients.”

- These findings foreshadow a larger issue.
CMMI: the Path Ahead

• New approaches needed (e.g. DAPMs).
  – Must be relatively cheap to implement.
  – Need to leverage existing workforce in novel ways.
  – Need to question underlying assumptions about disease processes and clinical measurement.

• To date no model has stressed the timeliness and accuracy of diagnosis.

- Current system is at best indifferent to diagnostic errors.
- Incorrect diagnosis can actually be rewarded.
APMs to Improve Diagnosis 2

• The paper made several recommendations including:
  – Change Medicare fee schedule to include billing codes for pathology/radiology communications as well as for diagnostic management teams.
  – Reduce documentation barriers and greater reward for cognitive work.
  – Make ACOs accountable for diagnostic timeliness and accuracy.
  – Condition based alternative payment models should assume the risk of correct diagnosis.

• How can DAPMs be proposed and implemented?
1st Generation DAPMs and PTAC

• Stage 1 Strategy: To minimize initial risk, seek early wins with fee for service coding and payment changes by leverage existing efforts based on:
  – **Diagnostic Management Teams**: evidence exist that DMTs:
    • Improved utilization rates for patients with **Lupus**.
    • **Reduced length of stay** for **pulmonary embolism** by 33% and for **intracranial hemorrhage** by 25%.
  – Greater **collaboration between pathology and radiology** in cancer diagnosis (consider increasing collaboration more generally).
  – Confirming diagnosis for diseases associated APMs.
2\textsuperscript{nd} Generation DAPMs

- DAPMs can further the value of healthcare in at least two areas:
  - Diagnosis of rare diseases.
  - Complex comorbid patients ("rare patients").
Adding Value: DAPMs and Rare Diseases

• In the UK it is estimated that 1 in 17 people have a rare disease, and rare diseases are a current focus of the UKs healthcare system.
  – Diagnosis is often long and costly.
  – Diseases are often scientifically informative.
  – The sharing of knowledge and the development of support groups difficult.
  • Web based models of collaboration have evolved to meet this need.
Patients with multiple comorbidities are a known cost driver in the US healthcare system.

At ASPE we undertook a study that calculated the distribution of multiple comorbidities in the Medicare population (32 million people) using Medicare claims data from 2008.

– For more detail see two papers on this study.
– Approximately 3,000 iCD-9 codes mapped to 70 hierarchical condition categories (HCC) for the disease combination (DC) analysis.
Disease Combination Analysis

Four Groups Were Identified:

<table>
<thead>
<tr>
<th>Group</th>
<th>% of Beneficiaries</th>
<th>% of Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) No HCC</td>
<td>35</td>
<td>6</td>
</tr>
<tr>
<td>2) 100 most prevalent DCs</td>
<td>33</td>
<td>15</td>
</tr>
<tr>
<td>3) Remaining 2,072,294 DCs</td>
<td>32</td>
<td>79</td>
</tr>
<tr>
<td>4) 1,658,233 Unique DCs</td>
<td>5.1</td>
<td>35</td>
</tr>
</tbody>
</table>
Long Tailed Distribution of Disease Combinations in Medicare

The graph displays the first 250 Diseases Combinations, ranked by prevalence, from the baseline HCC analysis. Note that the left Y-axis represents the proportion of the population that is included in each unique disease combination (black line). The right Y-axis represents the cumulative percent of the total population (red line) and the total expenditure (blue line), and is adjusted for the 32% of beneficiaries and 6% of expenditures that are associated with the no-HCC population. As there are over 2 million disease combinations calculated by this methodology, the figure’s X-axis would need to be extended over 8,000 fold to the reader’s right before both cumulative lines reached 100%.
Can We Prioritize Prevalent Conditions?

- No:
  - Restricting analysis to the 20 most prevalent of the 70 HCCs yields 53,476 DCs covering 40% of the population and 27% of expenditures.
  - Combined with the no-HCC group the 20 prevalent HCC DCs covers 75% of the population and 33% of expenditures.
  - Still missing 25% of the population and 67% of expenditures.
- Less common and rare diseases in aggregate are important drivers of expenditures.
- This accounts for the limited performance of prevalence based quality measures and current CMMI models.
What Does it All Mean?

- The problem is too complex for centralized top-down solutions.
  - Long tailed distribution that lacks useful means and measures of variance.
  - Distribution changes nationally over time.
  - No one provider or ACO has extensive experience with these patients.
- Must move toward an AI-supported decentralized crowd-sourced knowledge management solution.
- Systems that are optimized for rare diseases are a useful “North Star” as rare patients are the new normal.
- Critical need for 1\textsuperscript{st} and 2\textsuperscript{nd} generation DAPMs that improve diagnostic accuracy.
The Value Proposition for 2\textsuperscript{nd} Generation DAPMs

• Targets rare diseases and 80% of current fee for service expenditures.
  – Would seek payments for coordinating diagnosis with both internal providers as well as collaboration with external providers with similar patient problems.
  – Would crowd source access to knowledgeable providers for consultation.
• Would also assist with research request such as the development of data sets.
Moving From HIT to HICT

- DAPMs must move from health information technology (HIT) to health information and communications technology (HICT).
- Using HICT diagnostic teams can support two vital communication loops.
- 1st the “Inner Loop” provides care for a specific patient within the health care organization (the subject of active research).
- 2nd the “Outer Loop” consist of selected communications at the national level to support the care of a defined patient cluster.
  - May be built off of current efforts to support federated models of clinical research such as PCORI and OHDSI (note that the distinction between research and direct patient care will blur).
  - May incorporate distributed clinical crowd sourcing functions such as those being used in Project ECHO.
HICT

- Correct diagnosis is a critical requirement for useful communications across the healthcare enterprise.
- Follows treatment progress and outcomes locally while querying and comparing nationally.
- Coordinates between pathology, radiology and other sources of diagnostic information such as wearables.
- HICT is NOT useless emails and worthless reminders! These are examples of health information distraction technology!
Summary of Possible DAPM Strategy

• 1\textsuperscript{st} generation DAPM might be a PTAC proposal based on:
  – Diagnostic Management Teams.
  – Greater collaboration between pathology and radiology in cancer diagnosis (consider greater collaboration more generally).
  – As discussed previously confirm diagnosis for disease/condition associated APMs (e.g. chronic renal disease).
  – Initially prioritize "inner loop communications."

• 2\textsuperscript{nd} stage would be to develop DAPMs for rare diseases and complex patients.
  – Next prioritize "outer loop communications."
DAPM Risks and Challenges

• Technical
• Measurement of benefit (especially economic)
• Political
Conclusions

• To date efforts at health reform have ignored diagnosis, thus having limited impact and unintended consequences.
  – Not able to improve the care of the costly “long–tail” of comorbid patients.
  – Provider burden.
  – Implementation of poor clinical measures.
  – Lack of interoperability.
• Scientific and technical advances make it possible to improve the diagnostic process.
• Legal and administrative mechanisms exist to develop and nationally implement DAPMs.
• Unique opportunity for both Pathology and Radiology to develop DAPMs.
Thank You!

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**Phenotypic Disease Networks (PDNs)**

Nodes are diseases; links are correlations. Node color identifies the ICD9 category; node size is proportional to disease prevalence. Link color indicates correlation strength. Figure A. PDN constructed using $RR$. Only statistically significant links with $RR > 20$ are shown. Figure B. PDN built using $\phi$-correlation. Here all statistically significant links where $\phi > 0.06$ are shown.


http://www.ploscompbiol.org/article/info:doi/10.1371/journal.pcbi.1000353
### Example DCs by Prevalence (1-5 and 96-100)

<table>
<thead>
<tr>
<th>DC Rank</th>
<th>Number of Beneficiaries (%)</th>
<th>HCC(s) describing the DC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1,667,891 (5.17647)</td>
<td>19_Diabetes without Complication</td>
</tr>
<tr>
<td>2</td>
<td>764,522 (2.37277)</td>
<td>10_Breast, Prostate, Colorectal and Other Cancer</td>
</tr>
<tr>
<td>3</td>
<td>723,760 (2.24626)</td>
<td>108_Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>4</td>
<td>610,943 (1.89612)</td>
<td>105_Peripheral Vascular Disease</td>
</tr>
<tr>
<td>5</td>
<td>531,536 (1.64968)</td>
<td>92_Specified Heart Arrhythmias</td>
</tr>
<tr>
<td>96</td>
<td>19,237 (0.05970)</td>
<td>27_Chronic Hepatitis</td>
</tr>
<tr>
<td>97</td>
<td>19,196 (0.05958)</td>
<td>54_Schizophrenia &amp; 108_Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>98</td>
<td>18,806 (0.05837)</td>
<td>80_Congestive Heart Failure &amp; 92_Specified Heart Arrhythmias &amp; 131_Renal Failure</td>
</tr>
<tr>
<td>99</td>
<td>18,754 (0.05820)</td>
<td>101_Cerebral Palsy, Other Paralytic Syndromes</td>
</tr>
<tr>
<td>100</td>
<td>18,643 (0.05786)</td>
<td>38_Rheum Arthritis and Inflammatory Connective Tissue Disease &amp; 55_Major Depressive, Bipolar, Paranoid Disorders</td>
</tr>
</tbody>
</table>