Lumbar Imaging with Reporting of Epidemiology (LIRE): Lessons Learned

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11/6/15
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• PCORI: CE-12-11-4469

Disclosures (Jarvik)

• Physiosonix (ultrasound company)
  – Founder/stockholder
• Healthhelp (utilization review)
  – Consultant
• Evidence-Based Neuroimaging Diagnosis and Treatment (Springer)
  – Co-Editor
Background and Rationale

- Lumbar spine imaging frequently reveals incidental findings
- These findings may have an adverse effect on:
  - Subsequent healthcare utilization
  - Patient health related quality of life
Disc Degeneration in Asx
EXAMINATION: MRI L SPINE WO CONT
CLINICAL INDICATION: severe chronic low back pain with progressing right leg weakness without radiation of pain
TECHNIQUE: MRI Lumbar Spine without contrast : Sagittal T1, T2, STIR. Axial T1, T2.

FINDINGS:
ALIGNMENT: Normal alignment. No subluxations.
VERTEBRAE: Vertebral body height \( T \) signal are normal. Facets are intact. Small hemangioma within the L1 vertebral body.
SAGITTAL DISKS: Disc desiccation at L2-L3, L3-L4, L4-5, and L5-S1. Moderate disc height loss at L3-L4 and L5-S1. Endplate degenerative changes at L3-L4 and L5-S1. nodes
CONUS \( T \) CANAL DIAMETER: Lower thoracic spinal cord and conus are normal, ending at the L1-L2 level. Lumbar bony A-P canal diameter is normal and >13 mm.
SOFT TISSUES: Marked atrophy of the right psoas muscle.
AXIAL DISKS, DURAL COMPRESSION \( T \) FORAMINA:
L1-2: Normal.
L2-3: Mild ligamentum flavum buckling without significant central canal narrowing. No neural foraminal narrowing.
L3-4: Circumferential disc bulge, bilateral facet arthropathy, and ligamentum flavum buckling. No significant neural foraminal or central canal narrowing.
L4-5: Mild bilateral facet arthropathy and ligamentum flavum buckling. There is severe neural foraminal or central canal narrowing.
L5-S1: Small small disc extrusion with mild superior extent measuring approximately 6 mm, best seen on sagittal images. The extrusion causes mild impression on the ventral thecal sac. Bilateral facet arthropathy and ligamentum flavum buckling. Minimal bilateral neural foraminal narrowing.

IMPRESSION:
1. Mild multilevel degenerative changes of the lumbar spine as outlined above. The most significant levels at L5-S1 where there is a small disc extrusion with mild superior extent. There is also minimal bilateral neural foraminal narrowing.
2. Marked atrophy of the right psoas muscle.
Typical MRI Report

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Portions of a Typical MRI Report

Disc desiccation at L2-L3, L3-L4, L4-5, and L5-S1. Moderate disc height loss at L3-L4 and L5-S1. Endplate degenerative changes at L3-L4 and L5-S1.

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Communication

“The single biggest problem in communication is the illusion that it has taken place.”

George Bernard Shaw
The following findings are so common in normal, pain-free volunteers, that while we report their presence, they must be interpreted with caution and in the context of the clinical situation. Among people between the age of 40 and 60 years, who do not have back pain, a plain film x-ray will find that about:

- 8 in 10 have disk degeneration
- 6 in 10 have disk height loss

Note that even 3 in 10 means that the finding is quite common in people without back pain.
UH3 Hypothesis

• For patients referred from primary care, inserting epidemiological benchmark data in lumbar spine imaging reports will reduce (based on pilot data):
  – subsequent cross-sectional imaging (MR/CT)
  – opioid prescriptions
  – spinal injections
  – spine surgery

• >90% power to detect 5% diff in RVUs
Stepped Wedge RCT

- Exposed to LIRE intervention
- Unexposed to LIRE intervention

Follow-up period
Accrual period

*Randomization
wave 1
wave 2
wave 3
wave 4
wave 5

Period 0 Period 1 Period 2 Period 3 Period 4 Period 5
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4

Year 1 Year 2 Year 3 Year 4 Year 5

We are here
Enrollment Through 9/30/15
(4/6 waves complete; intervention “on” 78/100 sites)

<table>
<thead>
<tr>
<th>System</th>
<th># Primary Care Clinics</th>
<th># PCPs</th>
<th># Patients</th>
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<td>26</td>
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<tr>
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<td>352</td>
<td>9,226</td>
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<td>Total</td>
<td>100</td>
<td>2,480*</td>
<td>151,742*</td>
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# Data Availability

<table>
<thead>
<tr>
<th>1&lt;sup&gt;o&lt;/sup&gt; Outcomes: Spine-related CPTs → RVUs</th>
<th>2&lt;sup&gt;o&lt;/sup&gt; Outcomes</th>
<th>Additional Data</th>
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<tbody>
<tr>
<td>Imaging</td>
<td>Opioid Rx</td>
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### Getting The Data

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“There are many things that seem impossible only so long as one does not attempt them.”
— André Gide
| Easy | Easier | Hard | Hardest | Impossible |
|------|--------|------|---------|------------|------------|

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<td>Spine-related Procedure RVUs</td>
<td>Spine-related Visits</td>
<td>Radiology Reports</td>
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## Getting The Data - Primary Outcome: Spine-Related RVUs

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<td>Spine injections</td>
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<td>Spine surgeries</td>
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- Imaging, injections, surgeries: pilot data from BOLD indicating high quality* for 2 sites
  - Completeness
  - Accuracy
  - Consistency

*Zozus et al: Assessing data quality for healthcare systems data used in clinical research. NIH Health Care Systems Res Collaboratory White Paper
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- Spine-related visits: hard to determine if a visit was spine-related. ICD-9 codes not necessarily linked to visits/dates at 1 site
- Will develop working definition to determine spine-relatedness of visit
Visit Spine-Relatedness

- Spine-related ICD-9 code linked to visit
- Spine-related CPT code within 2 weeks of visit
- Visit to potential spine specialty provider (orthopedic surgeon, neurosurgeon, PM&R, anesthesiologist)
- Hospitalization with spine-related ICD-9 code within 30 days of visit
- Combinations of above for sensitivity analysis
### Getting The Data- Secondary Outcomes

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- All systems have complete prescribed data for scripts pts received in-system
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- All systems have complete prescribed data for scripts pts received in-system
- Hard to determine if a prescription was spine-related → look at all Rxs
## Getting The Data - Secondary Outcomes

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- All sites have text of radiology reports accessible
- One site, findings needed to be scrubbed of possible PHI
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- NLP to abstract report data
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<td>Gender</td>
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- Some mortality data exists within EMR but is incomplete
- Can query state and national databases, but info is delayed
- ED visits within system easy, but will miss out-of-system ED visits
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- Utilization history clustered on provider available through EMR at all sites
- Demographic information for providers varies by site (age, gender, specialty training)
Getting The Data

• More on Data Quality from Kari Stephens
Data Quality – Testing

Completeness
• Testing the denominators (patients/providers)
• Are all the columns and rows filled?
• Exploring other national datasets for comparison

Consistency
• Do keys make sense (MRNs are linked properly)
• Do the codes make sense (i.e., CPT, NDC)

Plausibility (Accuracy)
• Do patients have multiple medications
• Provenance – how did the data get this way?
Data Quality – Process

Iterative and customized

• Get data early
• Evaluate quickly
• Communicate effectively
• Create process to repeat
• Use emerging model and methods
Data Quality

Fitness for Use – discussions

• Study outcomes
  – Imaging, injections, surgeries, visits (for pain?)
  – Procedures and RVUs (for pain?)
  – Medications (prescribed for pain?)
Lessons Learned

1. Never get involved in a land war in Asia...
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data is important)
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data is important)
   a) BOLD/INVEST study data was key
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data is important)
   a) BOLD/INVEST study data was key
   b) Had data from prior studies that informed what we would actually be able to get
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data key)

2. Structure study so that most important data is easier to obtain
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data key)

2. Structure study so that most important data is easier to obtain
   - Primary Aims and Hypotheses should depend on “easiest” data
   - Leave “harder” data for secondary aims
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data key)

2. Structure study so that most important data is easier to obtain

3. Expect system changes that challenge ability to obtain data
   a) Change of EMR to Epic
   b) ICD-10: need for crosswalk to ICD-9
Lessons Learned

1. Know as much as possible what data will be easier, harder and hardest to get (pilot data key)

2. Structure study so that most important data is easier to obtain

3. Expect system changes that challenge ability to obtain data

4. Budget to obtain problem data (more bioinformatics & programmer time)
More Lessons Learned

• People: Make sure that at each site
  – you have the right skills for your team
  – you have strong political leadership
  – you have buy-in from all key players, not only leaders
  – there is a good personality fit among team members
Lessons Learned ➔
Hopefully will keep us in at least the right solar system...

“Shoot! You not only got the wrong planet, you got the wrong solar system. ... I mean, a wrong planet I can understand—but a whole solar system?”