Error, Injury & Loss in Medical Imaging

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Disclosures:

None
Objectives

1. Magnitude of errors & $ losses
2. Basis for major errors
3. Strategies to mitigate error, injury and losses
Error, Injury & Loss in Medical Imaging

- Error
- Injury
- Loss

$ Malpractice Cost
Societal Cost
Error and Lawsuits

• Most errors do not result in a claim or payments

• 37% of lawsuits have no medical error
  – Most are denied compensation

• Defense verdicts or $ payments don’t = error

• For every $1 paid in compensation......
  – 54 cents go to attorneys, expenses, court fees
  – 1 in 6 claims with errors --> no payment

• Disputing and paying for errors accounts for most of the $ spent

Localio et al NEJM 1991
Studdert et al Med Care 2000
Studdert et al NEJM 2006
Prevalence of Error

- Perceptual specialties: 5% diagnostic error
- Cognitive specialties: 10-15% diagnostic error
- Garland 1959
  - Rads miss 30% of positive findings
  - 4% overall error rate
- X-ray, Mamms, US: 3.5%
- CT: 32%
- Most rads don't study their errors

Garland AJR 1959
Rad Qual Inst 2012
Total Indemnity 2006-2015

- OB & Gyn: $1,396,522,114
- General Surgery: $853,403,358
- Internal Medicine: $810,788,957
- Radiology: $664,858,230
- Family Practice: $664,433,524
- Orthopedic Surgery: $554,701,753
- Anesthesiology: $365,386,376
- Emergency Medicine: $279,222,474
- Neurosurgery: $272,993,363

Error, Injury & Loss in Medical Imaging
## Claims in Radiology

<table>
<thead>
<tr>
<th>Condition</th>
<th>Claims with Indemnity</th>
<th>Share of Radiology Indemnity Dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast carcinoma</td>
<td>39%</td>
<td>12.1%</td>
</tr>
<tr>
<td>Lung carcinoma</td>
<td>36%</td>
<td>4.5%</td>
</tr>
<tr>
<td>Abdomen &amp; Pelvis Sx</td>
<td>26%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Spine fractures</td>
<td>30%</td>
<td>2.2%</td>
</tr>
</tbody>
</table>
# Claims in Medicine *By Error*

<table>
<thead>
<tr>
<th>Error</th>
<th>% of Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Failure to Diagnose</td>
<td>39%</td>
</tr>
<tr>
<td><em>Wrong or delayed</em></td>
<td></td>
</tr>
<tr>
<td>Failure to Test</td>
<td>32%</td>
</tr>
<tr>
<td><em>Wrong or delayed</em></td>
<td></td>
</tr>
<tr>
<td>Medication Error</td>
<td>19%</td>
</tr>
</tbody>
</table>

*TDC Closed Claims 2007-2014*
## Claims in Medicine By Venue

<table>
<thead>
<tr>
<th>Venue</th>
<th>% of Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office or Clinic</td>
<td>57%</td>
</tr>
<tr>
<td>Hospital</td>
<td>34%</td>
</tr>
<tr>
<td>SNF and Rehab</td>
<td>9%</td>
</tr>
</tbody>
</table>

*TDC Closed Claims 2007-2014*
## Claims in Medicine *By Condition*

<table>
<thead>
<tr>
<th>Condition</th>
<th>% of Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS</td>
<td>6%</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>5%</td>
</tr>
<tr>
<td>Colorectal Cancer</td>
<td>5%</td>
</tr>
<tr>
<td>Prostate Cancer</td>
<td>3%</td>
</tr>
</tbody>
</table>

*TDC Closed Claims 2007-2014*
# Claims in Medicine with Death

<table>
<thead>
<tr>
<th>Condition</th>
<th>% of Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACS</td>
<td>19%</td>
</tr>
<tr>
<td>Medication Error</td>
<td>12%</td>
</tr>
<tr>
<td>Sepsis</td>
<td>8%</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>5%</td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>5%</td>
</tr>
<tr>
<td>Gastric &amp; Colon Cancer</td>
<td>3%</td>
</tr>
</tbody>
</table>

*TDC Closed Claims 2007-2014*
Main Allegations of Liability

• Perceptual error
• Interpretation error
• Failure to communicate in a timely and appropriate manner
• Failure to suggest the next appropriate study or action

• Procedural complications
Error Patterns from Missed Cases

- 558 cases reviewed over 92 months
  - 80% perceptual errors
  - 20% interpretive errors
- X-ray: lung nodules, fractures, mets
- CT: bone lesions, blood clots, GI tumors
- 56% subtle, 44% non-subtle

Why so many errors?

Donald et al JMI Rad Onc 2012
System I - Fast
- Automatic & unconscious
- Effortless decisions shaped by context
- Great pattern recognition
- Impaired by cognitive bias

System II - Slow
- Deliberate & conscious
- Effortful decision-making
- Reasoned conclusions
- Impaired by fatigue, hunger, distraction
Basis of Perceptual Errors

- Limits of thinking & visual perception
- Alertness
- Fatigue
- Task duration
- Distraction
- Ambient conditions
- Target prevalence: frequency of lesions
Target Prevalence

• Given finding missed 30% when present < 1% of the time
  – Screening mammography
  – Screening CT for lung cancer
  – Airport screening

• Given finding missed only 7% when present 50% of the time
Commonly Missed Lesions

- Breast lesions in mammography
- Lung nodules on CXR, CT
- Foreign bodies (*gorilla-like*)
- Fractures
- Bone tumors on plain x-rays
- **Stroke**

PIAA 2016
Interpretation Error

- Knowledge
- Experience
- Judgment
- History
- Prior studies, prior reports
- Bias
Interpretation Error - Bias

- **Availability bias**: favor easily remembered dx
- **Framing bias**: undue influence by history
- **Regret bias**: wrongly estimate chance of bad dx
- **Confirmation bias**: support 1 dx, discount others
- **Attribution bias**: dx limited based on patient type
- **Alliteration bias**: repeating previous errors
- **Commission bias**: need to do ‘something’
- **Omission bias**: afraid to do ‘something’
- **Hindsight bias**: over-estimate dx later proven
Use of Clinical History

• Correct history
  – Increase in true-positives from 38% to 84%

• Ideally, read history *after* first review
  – False-positives are reduced
  – No impact on false-negatives (misses)

• Requires great discipline

• Fictitious history
  – Increases false observations

*Griscom Radiology 2002
Doubilet AJR 1982*
Outpatient pre-op CXR
Friday night 7 PM
Three day weekend
Communication Errors

• ‘Standard’ is established by experts
• Viewed very negatively to fail
• Delayed dx breast cancer *with failed communication*
  – Awards/settlements higher by > 2X
  – Indemnity attributed to radiologist higher by 4 to 15X
Communication Failures

- 23,658 cases 2009-2013
- Communication issues 30% of cases
- 7,149 cases $1.7B in losses
- ‘Information is the currency of safe care’

CRICO 2015 Annual Benchmark Report
Reducing Perception Errors

Type I Thinking, Environment, Percepts

• Cognitive de-biasing: *force* Type II think
  – Context: ie COPD – *hunt for nodules*
  – Blind spots: *learn, build personal check-list*
  – Disengaged? *use a magnifying tool, invert*
  – Missed case review

• Environment: work to optimize

• Percepts
  – CAD for mamms, CXR, chest CT?
CADe DETECTION

6 months earlier
ROC Curves

1. Find the breast cancers
2. Avoid over-calls
* = Calcification  ○ = Mass  ∆ = Distortion
ROC Curves +/- CAD

Rad only

Rad with CADe

CAD for Mamms
- Reduced accuracy
- Increased biopsy rate
- **NOT** clearly associated with improved detection of invasive breast cancer
- Become routine in US

NEJM 2007

Error, Injury & Loss in Medical Imaging
Artificial Intelligence

• Great promise to enhance diagnostics
• Benefit to *perceptual* & *cognitive* specialties
• Death of radiology has been predicted
• Real opportunity lies in *decreasing risk*
• Errors in radiology
  1. Perception
  2. Interpretation
  3. Communication
* = Calcification  ○ = Mass  ∆ = Distortion
Mitigating Risk in Medicine

- Focus on presenting hx, especially repeat visits
- Evaluate patients all ages with atypical chest pain
- Pay close attention to post-op complaints
- Document well, including phone advice
- Clear office policies on tracking test results
- Confirm understanding of plan, Rx, follow-up
- Confirm intention ability to buy Rx, make f/u
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