Determining Medical Causation

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Declare

• The Hand Center
• MAP Managers, owner of CtdMAP
• PHI = Physical Health Index – Health Assessment
• Books: Physician's Guide to Return To Work, Guides to the Evaluation of Disease and Injury Causation, etc
• Professional Organizations: ABA, AMA, AADEP, AAOS, ACOEM, ASSH, AAHS, IAIABC, SDPM, etc
• Organizations: MDA, ODG, SEAK, etc
• Speaker: multiple national and state level organizations
• Reviewer: multiple journals and books
• Any other task or job that will improve outcomes for injured workers
Occupational Health

5 Primary Issues

1. Dx
2. Causation
3. Treatment
4. Return to Work
5. Impairment & Disability

Occupational Health

5 Primary Issues

1. Dx
2. Causation – who is responsible for costs
3. Treatment – cost of care & outcomes
4. Return to Work – disability duration
5. Impairment & Disability – final costs
Causation Example

What type of tree is hit by lightning more frequently than others?

- Simple question
- Frequency established
- What is the cause?

Causation

- Medical – Science

- Legal – Social justice

Causation – Medical - Science

- Direct causal association = a causes b
- Indirect causal association = a causes b only if c is present (i.e., poverty does not cause disease)
- A noncausal relationship (correlation) exits when a factor other than the event in question is responsible for the outcome
Causation – Medical - Science

• Physicians and statisticians use statistics to arrive at suggestions from observational studies that A probably caused B.
• Biostatistics can never establish exact cause and effect but gives the probability (eg, p < 0.05) that A contributed to B.

Causation - Legal

• In a causation analysis, the law considers two separate and distinct components:
  • cause in fact and
  • proximate (or legal) cause.

Causation - Legal

• cause in fact

  • If one event brings about another, the former can be considered the cause in fact of the latter, regardless of the number of events involved.
Causation - Legal

• proximate (or legal) cause

• The second part of causation analysis seeks to determine whether two events that are linked in fact should also be linked in law.
• Are the two events so closely linked that liability should be attached.

Primary Source

• Chapter 1 to 7
• Provides the foundation for understanding the relative risk as established by epidemiology and the likelihood of developing the Dx after exposure

Risk

• We rarely have RCTs about causation risk factors, as we rarely can randomize people to risk (the left half of the room will smoke, the right half of the room will not smoke).
• Or use the parachute study
**Prospective Cohort Study**

- Outcome of interest, with no current evidence of outcome, now exposed to risk
- Outcome of interest, with no current evidence of outcome, not exposed to risk
- Outcome = Dx or Disease
- Risk = risk factor = toxin = work task
  = smoking = asbestos = etc
- Statistics = Relative Risk
- Weakness = usually not double blinded

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**Relative Risk**

- Relative risks come from prospective cohort in which you know the denominators (how many are in each group you’re following).
- You are dividing know risk (absolute risk) in the exposed group by the risk in the unexposed group.

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**Relative Risk = RR**

RR is the probability of the event occurring in the exposed group vs the non-exposed group – where # = probability = incidence

RR = # exposed / # non-exposed

<table>
<thead>
<tr>
<th>Risk</th>
<th>Disease Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoker</td>
<td>A</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>C</td>
</tr>
</tbody>
</table>
Relative Risk = RR

RR = # exposed / # non-exposed

- if lung CA is 20% in a smoker and 1% in a non-smoker

<table>
<thead>
<tr>
<th>Risk</th>
<th>Disease Status</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>Smoker</td>
<td>A = 20</td>
<td>B = 80</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>C = 1</td>
<td>D = 99</td>
</tr>
</tbody>
</table>

RR = a/(a+b) = 20/100 = 20

- c/(c+d) = 1/100

Hazard Ratio = HR

- Hazard ratios (HR) are cumulative over an entire study, "averaging" multiple outcomes at multiple times until a defined endpoint, while relative risk (RR) represents instantaneous risk over the ONE study time period.

When graphs over time, like this, are in an article, they are usually reporting Hazard Ratios.

Chapter 4 Methodology

- Literature Search and Causations Analysis
- Strength of Evidence Definitions
- Study Design
- Strength of Evidence of Causation
• Limitations and Other Considerations
• Epidemiologic surveillance studies and aggregate information about occupational risk and the development of specific medical conditions are commonly confounded by psychosocial factors.
Primary Source

- Great

- So how do I use this information?

Step 1
Or use
The Causation Book
"Blue Book"

Table 3-1 Steps for Concluding a Causal Association Exists

1. Collect all epidemiologic literature on the disorder
2. Identify the design of each study, giving stronger consideration to superior study designs, provided each study has sound methodology
3. Assess the methods of each study, including the existence and degree of:
   a. Exposure assessment methods with potential biases
   b. Disease ascertainment methods and potential biases
   c. Absence of significant uncontrolled confounders; consideration of residual confounding
   d. Attribution of other potential biases; or, total flaws
   e. Appropriateness of biostatistical methods and analytical techniques
4. Assess statistical significance and the degree to which chance may have produced the results
5. Assess the studies using the Updated Hill Criteria; apply the criteria to individual studies independently or to the studies as a whole
   a. Temporality
   b. Strength of association
   c. Dose-response relationship
   d. Consistency
   e. Coherence
   f. Specificity
   g. Plausibility
   h. Biological plausibility
   i. Experiment
   j. Analogy
   k. Predictive performance
6. Conclusion about the degree to which a causal association is or is not present

Step 2 Table 3-2 NIOSH / ACOEM

1. Identify evidence of the disease = Dx
2. Review and assess the available epidemiological evidence for a causal relationship
3. Obtain and assess the evidence of exposure
4. Consider other relevant factors
5. Judge the validity of testimony
6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation
### Step 3 Table 3-3 Exposure Hierarchy

1. Quantified personal or individualized measurement
2. Quantified surrogate of exposure (another worker doing same job)
3. Quantified pseudosurrogates of exposure (another worker doing similar job)
4. Employment in a defined job category
5. Employment in a defined job trade
6. Employment in a plant or obtained from employer

### Step 4 Consider other relevant factors

1. Individual risk factors (listed in causation book)
2. Use Hill criteria to apply epidemiological data to specific individual
   a. Temporality
   b. Strength of association
   c. Dose-response relationship
   d. Consistency
   e. Coherence

   Use Hill criteria to apply epidemiological data to condition in general less to specific individual
   f. Specificity
   g. Plausibility
   h. Reversibility
   i. Prevention/elimination
   j. Experiment
   k. Analogy
   l. Predictive performance
Step 5 Judge the Validity of Testimony

This step involves 2 main issues.
1. Is information that may suggest to the provider that there is a conflict regarding some important aspect, such as date of injury, mechanism, or prior injury status.
2. The other may deal with broader issues, such as opinions given that are not evidence-based or whether analyses and/or tests performed were appropriate.

Step 6 Conclusions about work-related

1. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation based on an understanding of the legal threshold upon which your opinion must be based. (see chapter 2)

Causation

Preponderance of the evidence = more probable than not
A two-part test is applied in determining causation: (1) Where the claimant suffers from a preexisting condition which contributes to the injury, an unusual or extraordinary exertion is required to prove legal causation; where there is no preexisting condition, a usual or ordinary exertion is sufficient. (2) Under the medical cause test, the claimant must show by evidence, opinion, or otherwise that the stress, strain, or exertion required by his or her occupation led to the resulting injury or disability, and in the event the claimant cannot show a medical causal connection, compensation should be denied. Affeld v. Industrial Comm’n, 720 P.2d 13 (Utah 1986); Smidt v. Board of Review, 831 P.2d 718 (Utah Ct. App. 1992).

Chapter 9 Upper Limb

Upper Limb

CTS - Causation
CTS - Causation

• 40 year old female
• 20 years on production line plastic cooler
• Recently switched to new line – larger jugs
• 2 year history of progress numbness at night thumb, index, and middle finger bilateral

CTS - Causation

• Symptoms are worse at end of day
• Awaken at night – shakes hands out
• BMI 29 (moderately overweight – age appropriate ?)
• Smokes 2 ppd
• Social EtOH
• Likes to play with grand children

CTS - Causation

• Treated with night splint – some improvement
• NSAID’s – maybe help
• Wrist injection x 2 with improvement
• X-rays shown slight CMC thumb OA
• NCT consistent with median nerve entrapment wrist
CTS - Causation

- Filed WC claim
- Insurer is requesting a causation opinion.
- Is her work as a plastic production line employee the cause for her CTS for which you have recommend surgery?

CTS - Causation

- Patient said “the job is the cause”
- Many physician’s repeat this statement in their medical record
- The job then becomes “the cause”
- But what is the science?

Step 2 Table 3-2 NIOSH / ACOEM

1. Identify evidence of the disease = Dx
2. Review and assess the available epidemiological evidence for a causal relationship
3. Obtain and assess the evidence of exposure
4. Consider other relevant factors
5. Judge the validity of testimony
6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation
1. Identify evidence of the disease = Dx
   Can you confirm her diagnosis as CTS?

2. Review and assess the available epidemiological evidence for a causal relationship

- Combination of force & repetition, force & posture = very strong evidence
- Vibration = low risk
- Highly repetitive work alone = conflicting
- Highly repetitive work in combination = strong evidence

- Forceful work = very strong evidence
- Awkward postures = low risk
- Keyboard = insufficient evidence
- Cold environment = insufficient evidence
- Length of employment = insufficient evidence
- Job satisfaction = some evidence
3. Obtain and assess the evidence of exposure
   • Primary job is making jugs
   • What does that involve?
   • Hours per day
   • Days per week
   • Essential Functions of the Job

3. Obtain and assess the evidence of exposure
   Standard forms can be helpful

3. Obtain and assess the evidence of exposure
   • The jugs weight 15 lbs.
   • Required knife to cut of plastic tails
   • Forceful grasping and repetition
   • Machine paced
CTS - Causation

3. Obtain and assess the evidence of exposure
   • Is this her only risk exposure?
   • Hobbies – watches TV with grandkids
   • ROS and comorbidities are negative

CTS - Causation

4. Consider other relevant factors
   • Age = very strong evidence
   • BMI = very strong evidence
   • Gender = very strong evidence = female
   • Biopsychosocial factors = very strong evidence
   • Diabetes = very strong evidence

CTS - Causation

4. Consider other relevant factors
   • Dominant hand = insufficient evidence
   • Smoking = low evidence
   • Genetic = very strong evidence
   • Alcohol consumption = insufficient evidence
   • Carpal tunnel size (ratio) = some evidence
CTS - Causation

4. Consider other relevant factors
   • Non occupational (gardening & knitting) = some evidence

CTS - Causation

5. Judge the validity of testimony
   • Patients says “the job is the cause”
   • Job description by patient
   • Job description by employer
   • Video of job
   • Onsite viewing of job

CTS - Causation

5. Judge the validity of testimony
   • Occupational risk factors would be
     1. Combination of force & repetition, force & posture = very strong evidence
     2. Highly repetitive work in combination = strong evidence
CTS - Causation

5. Judge the validity of testimony
   • Occupational risk factors would be

3. Forceful work = very strong evidence
4. Job satisfaction = some evidence

CTS - Causation

5. Judge the validity of testimony
   • Her nonoccupational risk factors would be

1. Age = very strong evidence
2. BMI = very strong evidence
3. Gender = very strong evidence
4. Biopsychosocial factors = very strong evidence

CTS - Causation

6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation.
   • The scientific evidence would suggest that this individual has occupational and nonoccupational (individual) risk factors
CTS - Causation

• So how do you answer the original question –

• Is her work as a plastic production line employee the cause for her CTS for which you have recommend surgery?

CTS - Causation

• Remember

• Medical – Science

• Legal – Social justice

• The judge has the final say.

Rotator Cuff Disease = RC
RC - Causation

• 55 year old male
• 30 years as commercial electrician
• Recently changed jobs with new employer (6 months)
• 2 year history of progress pain in right shoulder with decreasing ROM

RC - Causation

• Symptoms are worse at end of day
• Awaken at night when rolling on to right shoulder
• BMI 34 (Obese Class I = Moderately obese – age appropriate ?)
• Smokes 1 ppd
• Social EtOH
• Hunts & belongs to skeet shooting club

RC - Causation

• Treated with shoulder injection 2 years ago – some improvement
• NSAID’s – maybe help
• Recent injection x 2 with improvement
• X-rays shown AC narrowing, slight glenohumeral OA
• MRI – degenerative tear, fatty infiltrate in retracted supraspinatus muscle
**RC - Causation**

- Filed WC claim with current employer
- Insurer is requesting a causation opinion.
- Is his work as a commercial electrician the cause for his rotator cuff tear (RC) for which you have recommend surgery?

<table>
<thead>
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<th><strong>RC - Causation</strong></th>
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<td>Patient said “the job is the cause”</td>
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<td>Many physician’s repeat this statement in their medical record</td>
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<tr>
<td>The job then becomes “the cause”</td>
</tr>
<tr>
<td>But what is the science?</td>
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</table>

**RC - Causation**

Perhaps a better question is which job?

- 30 years with the first employer or 6 months with second employer
- No history of trauma
- Would history of injury with new employer change your answer?
Step 2 Table 3-2 NIOSH / ACOEM

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RC - Causation

1. Identify evidence of the disease = Dx

Can you confirm his diagnosis as RC?

2. Review and assess the available epidemiological evidence for a causal relationship

RC - Causation

• Combination of force & repetition, force & posture = some evidence
• Vibration = insufficient evidence
• Highly repetitive work alone = some evidence
• Highly repetitive work in combination = some evidence
RC - Causation

• Forceful work = insufficient evidence
• Awkward postures = strong evidence (>60 degrees flexion or abduction)
• Keyboard = insufficient evidence
• Cold environment = insufficient evidence
• Length of employment = insufficient evidence

RC - Causation

3. Obtain and assess the evidence of exposure
   • Primary job is install electrical items
   • What does that involve?
   • Hours per day
   • Days per week
   • Essential Functions of the Job
RC - Causation

3. Obtain and assess the evidence of exposure

Standard forms can be helpful

RC - Causation

3. Obtain and assess the evidence of exposure

• Force and repetition (but rest periods)
• Forceful grasping and repetition
• Awkward postures
• Self paced?

RC - Causation

3. Obtain and assess the evidence of exposure

• Is this his only risk exposure?
• Hobbies – shooting
• ROS and comorbidities – positive for diabetes
RC - Causation

4. Consider other relevant factors
   • Age = very strong evidence
   • BMI = strong evidence
   • Gender = insufficient evidence
   • Biopsychosocial factors = strong evidence
   • Diabetes = some evidence

RC - Causation

4. Consider other relevant factors
   • Dominant hand = insufficient evidence
   • Smoking = low risk evidence
   • Genetic = insufficient

RC - Causation

4. Consider other relevant factors
   • Non occupational = shooting? Any science? Can you extrapolate?
RC - Causation

5. Judge the validity of testimony
   • Patients says “the job is the cause”
   • Job description by patient
   • Job description by employer
   • Video of job
   • Onsite viewing of job

RC - Causation

5. Judge the validity of testimony
   • Occupational risk factors would be
     1. Combination of force & repetition, force & posture = some evidence
     2. Highly repetitive work in combination = some evidence

RC - Causation

5. Judge the validity of testimony
   • Occupational risk factors would be
     3. Awkward postures = strong evidence
RC - Causation

5. Judge the validity of testimony
   • His nonoccupational risk factors would be
     1. Age = very strong evidence
     2. BMI = strong evidence
     4. Biopsychosocial factors = strong evidence
     5. Shooting

RC - Causation

6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation.
   • The scientific evidence would suggest that this individual has occupational and nonoccupational (individual) risk factors

RC - Causation

• So how do you answer the original question –
  • Is his work as a commercial electrician the cause for her RC for which you have recommend surgery?
RC - Causation

- So how do you answer the original question –

- Which employer?
- Do you do an apportionment?


RC - Causation

- So how do you answer the original question –

- Does the degenerative tear, fatty infiltrate and retracted supraspinatus muscle – change you opinion?
RC - Causation

• Remember
• Medical - Science
• Legal - Social justice
• The judge has the final say.

Occupational Health

5 Primary Issues

1. Causation
2. Cost of care & outcomes
3. Treatment Outcome
4. Return to Work
5. Impairment & Disability

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