CAUSATION-AN INTRODUCTION

Presentation to CCWC:
Applying Evidence Based Standards to Causation of Injury
Presenters

• MARK H. HYMAN, MD, FACP, FIAIME
  • ASSOCIATE CLINICAL PROFESSOR OF MEDICINE, UCLA
• Negar Matian, Esq.
• Saul Allweiss, Esq.

Causation and Risk
DISCLAIMERS

• The information for practitioners notes that decisions to adopt particular courses of actions must be made by trained practitioners and on the basis of the available resources and the particular circumstances presented by the individual patient. Accordingly, the above disclaims responsibility for any injury or damage resulting from actions taken by practitioners after considering these guides.

DISCLAIMERS

• I DID NOT SAY WHAT YOU THOUGHT I SAID
• YOU DID NOT HEAR WHAT YOU THOUGHT YOU HEARD
• ANY STATEMENT THAT IS AN ERROR IS MY FAULT AND NOT THE FAULT OF MY CO-EDITORS OR CHAPTER AUTHORS
ACKNOWLEDGMENTS

• MARK MELHORN AND JIM TALMAGE
• AMA
• IAIME
• ACOEM
• MD GUIDELINES BY THE REED GROUP
• MY FAMILY
• THE OFFICE STAFF
Editors WILL RECEIVE Royalties

FINANCIAL CONFLICT OF INTEREST

FINANCIAL CONFLICT OF INTEREST
FINANCIAL CONFLICT OF INTEREST

Editor(me) WILL RECEIVE Royalties

FINANCIAL CONFLICT OF INTEREST

Editors WILL RECEIVE Royalties
FINANCIAL CONFLICT OF INTEREST

I AM A PAID CONSULTANT TO MD GUIDELINES WHICH MAY COME UP IN OUR DISCUSSION

I PRACTICE MEDICINE FULL TIME, I SUPPORT MY OFFICE STAFF AND MY FAMILY, SO I HAVE A FINANCIAL CONFLICT OF INTEREST BEING HERE AS OPPOSED TO BEING IN MY OFFICE

REST STOP
Causation Example

Which Duck is more likely to find a mate?

A

WHY?

B

Bright Orange Legs =
Vitamins = beta-carotene
More Antioxidants
Better immune system
Better genes = Better Mate
Causation Example
What type of tree is hit by lightning more frequently than others?
• Simple question
• Frequency established
• What is the cause?

Causation Example
What type of tree is hit by lightning more frequently than others?
• Hint
• National Tree
• Why?
Causation Example

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

1. Generally grows taller
2. Deeper roots
3. High moisture content
4. More conductive

Causation Example

Who is more likely to have an ACL Strain - Tear from Jumping?

1. Males
2. Females
3. Tall people
4. Increased tibial slope angle
Causation Example

Who is more likely to have an ACL Strain - Tear from Jumping?

1. Males
2. Females
3. Tall people
4. Increased tibial slope angle

Causation Example

Long-term exposure to residential road traffic noise is associated with a higher risk of MI?

Yes
No
Causation Example

Yes

- Prospective cohort 57,053
- Incidence rate ratio 1.12 per 10 dB
- Yearly exposures 95% CI: 1.02-1.22
- 5 years 95% CI: 1.02-1.23
- Linear dose-response relationship


Causation Example

Long-term exposure to Powerpoint presentations results in a lower IQ after 60 minutes?

Yes

No
Causation Example

Long-term exposure to Powerpoint presentations results in low IQ after 60 minutes. - No current study
Chapter 2 Understanding Work-Relatedness

- Prevalent Perceptions
- Cause In Fact
- Proximate Cause
- Epistemology
- Definition of Terms
- Thresholds

Risk & Causation

Risk and Causation is an inexact science

Unlike the ‘God Particle’ which might lead us to God
Causation

- Medical – Science

- Legal – Social justice
  - See e.g. Kenneth Feinberg
  - Book *Who Gets What*. Served as special master for Agent Orange, 9/11, Hokie Spirit, Gulf Oil Spill

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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
    • 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.
  • 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.
Epistemology

- **Épis tēmol’ōgy** (noun)

- Greek *epistēmē*, knowledge and *logos* discourse
- One of the 4 disciplines of philosophy
- The theory or science that investigates the origin, nature, methods, and limits of knowledge

Thresholds

- Not single system
- Complex set of judicial & legislative rules
- Different for each state, territory, etc

- Threshold requirement varies from iota to significant
Thresholds

- E.g. California uses RDOMP—reasonable degree of medical probability
- Longshore uses MPTN—more probable than not
- FECA (Federal Employee’s Compensation Act) uses POTE—preponderance of the evidence

- These thresholds are further impacted by Frye vs Daubert standard. These standards require levels of scientific evidence and how they are admitted into the legal proceedings.

Rest Stop

ONE JOB...

YOU HAD ONE JOB
Chapter 3-Causal Associations and Determination of Work Relatedness

- Epidemiology vs. Individual Causal Assessments
- Epidemiologically Based Causal Associations
- Determination of Work-Relatedness of Disease
- Conclusions

Falsifiability

- Austrian philosopher Karl Popper
- Belief that we can’t ever prove statements or theories to be true, but we may be able to prove they are false
- Science depends on the principle of falsifiability
- This differs somewhat from Thomas Jefferson who wrote to Martin Van Buren in 1824:
  - proof is the duty of the affirmative side, A negative cannot be positively proved
Falsifiability

- We can NOT prove “all crows are black”.
- There may be a green crow somewhere.
- If we do find a green crow, we have falsified the claim that all crows are black.

Limitations of Epidemiology

- Epidemiology:
  - (Lit.) The study of what is upon people
  - Descriptive and experimental
- Quant Science:
  - French mathematician Louis Jean-Baptiste Aphonse Bachelier wrote the Theory of Speculation in 1900
  - Speculative, it is estimating something that is unknown
Limitations of Epidemiology

• Like Science in general, Epidemiology can **not** prove a theory.

• **Epidemiology can disprove a theory.**
  - Can establish that proposed explanation or association is due to chance.
  - Can disprove a theory’s predictions.


Limitations of Epidemiology

• **Potential Errors in Cross Sectional and Retrospective Studies (the Big Four):**
  1. Chance-try to avoid with the statistics
  2. Confounding-not all factors were considered
  3. Bias-who wrote this and why, systematic measurement errors
  4. Generalizability-what population was studied and do these apply to other populations

Causation

Causation Table 3-1

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
Causation Table 3-1

3. Assess the methods of each study, including the existence and degree of:
   a. Exposure assessment methods and potential biases
   b. Disease ascertainment methods and potential biases
   c. Absence of significant uncontrolled confounders; consideration of residual confounding
   d. Addressing of other potential biases or fatal flaws
   e. Adequacy of biostatistical methods and analytical techniques

Causation Table 3-1

4. Ascertain statistical significance and the degree to which chance may have produced the results
### Causation Table 3-1

5. Assess the studies using the Updated Hill Criteria; apply the criteria to individual studies (especially 5a-5c) and to the studies as a whole (5a-5l)

a. Temporality-which comes first  
b. Strength of association-how often  
c. Dose-response relationship-biologic gradient  
d. Consistency-association seen by different people and places  
e. Coherence-data does not conflict with facts  

f. Specificity—cause associated with specific disease  
g. Plausibility-absurd causes R/O  
h. Reversibility-achievable if removed  
i. Prevention/elimination-if possible  
j. Experiment-if available  
k. Analogy-weaker evidence  
l. Predictive performance-c/w known exposure
Causation Table 3-1

6. Conclusion about the degree to which a causal association is or is not present

<table>
<thead>
<tr>
<th>Hypothesis Generating</th>
<th>Hypothesis TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non – Epidemiological reports</td>
<td>Prospective Cohort</td>
</tr>
<tr>
<td>Case Reports</td>
<td>Retrospective Cohort</td>
</tr>
<tr>
<td>Consecutive Case Series</td>
<td>Case-Control</td>
</tr>
<tr>
<td>Ecological Study</td>
<td>Cross-Sectional</td>
</tr>
<tr>
<td>Proportionate Mortality Ratio Study</td>
<td>Most Common but Least Helpful</td>
</tr>
<tr>
<td>Least Common but Best Data</td>
<td>Chapter 4</td>
</tr>
</tbody>
</table>

Figure 3-1: Study Design Pyramid (2nd edition Causation pg 107)
Risk and the RCT

- 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 - the next best thing

- Prospective investigation (you are following a group forward in time) of the factors that might cause a disorder (i.e. a suspected risk factor) in which a cohort of individuals who do not have evidence of an outcome of interest (i.e. a disease) but who are exposed to the “risk factor” are compared with a concurrent cohort who are also free of the outcome but not exposed to the “risk factor”. Both cohorts are then followed to compare the incidence of the outcome of interest.
- Best study design if subjects can NOT be randomized
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
- A risk factor = toxin, work task, smoking, asbestos, etc
- Statistics = Relative Risk
- Weakness = usually not double blinded

Relative Risk = RR

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

RR is the probability of the event occurring in the exposed group vs the non exposed group
RR = # exposed(a/(a+b)) / # non-exposed(c/(c+d))

<table>
<thead>
<tr>
<th>Risk</th>
<th>Disease Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoker</td>
<td>Present</td>
</tr>
<tr>
<td>Non-smoker</td>
<td>Absent</td>
</tr>
</tbody>
</table>

The risk of lung cancer is 20% in smokers
\[
a/(a+b) = 20/100
\]
The risk of lung cancer is 1% in non-smokers
\[
c/(c+d) = 1/100
\]
Thus if lung CA is 20% in a smoker and 1% in a non smoker, the RR = 20
Relative Risk = RR

Another example
If disease X or Dx X is 2% in the exposed group
\[ \frac{a}{a+b} = \frac{2}{100} = 2\% \]
And disease X or diagnosis X is 1% in the unexposed group
\[ \frac{c}{c+d} = \frac{1}{100} = 1\% \]
Then the RR is 2

<table>
<thead>
<tr>
<th>Risk</th>
<th>Disease Status</th>
<th>Present</th>
<th>Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed</td>
<td>A = 2</td>
<td>B = 98</td>
<td></td>
<td>100</td>
</tr>
<tr>
<td>Non-exposed</td>
<td>C = 1</td>
<td>D = 99</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

Relative Risk = RR

- A RR of > 1 means the event is more likely to occur in the experimental group than in the control group.

- A RR of >2 is sufficient to consider an association for causation. This is one of the thresholds used in the Causation book, Some epidemiologic literature does NOT consider this a high enough standard.
Hazard Ratio = HR

- Hazard ratios (HR) are usually used in survival analysis to represent the ratio of occurrence rate in an exposed group compared to occurrence rate in an unexposed group. This measure is time dependent since survival analysis is based on when events occur.

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

Case Control Study

- Cases with a diagnosed condition are compared to a control group without the disease
- If the cases are new, then this is incidence
- If the cases are both new and old from the past, then this is prevalence
- Data is collected on current and/or previous exposures in both groups
- The data is "searched", "reviewed", "data mined" for factors that could increase the risk or reduce the risk
Case Control Study

• **Example:** Incidence of rotator cuff tears in factory workers with and without exposure to overhead work

• Statistics provides Odds ratio (not RR)

• Weakness: susceptible to biases and you do not know prevalence in a population

Odds Ratio

• Odds ratios come from case control studies in which you have cases, but not a denominator, i.e. you do not know how many were exposed.

• You don’t know the absolute risk, but a risk factor occurs more commonly (or less commonly) in the study group (cases) than in the control group.
Odds Ratio

• The odds ratio is a measure of effect size, describing the strength of association or non-independence between two binary data values
• The odds ratio treats the two variables being compared symmetrically

If the probabilities of the event in each of the groups are $p_1$ (first group) and $p_2$ (second group), then the odds ratio is:

$$OR = \frac{p_1/(1-p_1)}{p_2/(1-p_2)}$$
Odds Ratio

• Sample of 100 men & 100 women who drank beer in the previous week
• 90 male and 20 women drank beer
• Odds for male 90 to 10, or 9:1
• Odds for woman 20 to 80, or 1:4 = 0.25:1
• The odds ratio (OR) = 9/0.25, or 36
• Therefore men are more likely to drink beer

Odds Ratio

• Thus men are much more likely to drink beer than women
• Using natural logarithms, an odds ratio of 36/1 maps to 3.584 times
• But in this study 90/20 = 4.5 times
• Why the difference? In statistics, an effect size is a measure of the strength of a phenomenon
• An effect size calculated from data is a descriptive statistic that conveys the estimated magnitude of a relationship without making any statement about whether the apparent relationship in the data reflects a true relationship in the population.
Odds Ratio

Epidemiologists have found that:
• If Observational studies show an ODDS RATIO of < 3, future prospective controlled studies rarely find a causal association
• The apparent risk is usually attributable to confounding by biases.

*Master the AMA Guides, Fifth Appendix A, Judging Causation, 2001*

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Cause

• How do you apply this body of knowledge about “people” in general to the “individual” sitting in front of me?
Cause – 2 Things to consider

1. Could this exposure or risk factor cause or be part of the cause of this condition (disease) in any person?

2. In this particular person, DID THIS exposure ACTUALLY cause or contribute to this person’s condition (disease)?

Cause

• Six “easy” steps to scientifically support your opinion on causation
• or
How to link group data to the individual
Cause-Determination of Work-Relatedness Using Table 3-2

1. Identify evidence of disease
2. Review and assess the available epidemiologic evidence for a causal relationship
3. Obtain and assess the evidence of exposure
4. Consider other relevant factors
5. Judge the validity
6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation

Causation Table 3-2

1. **Identify evidence of disease**
   - What is the disease?
   - Is the diagnosis correct?
   - Does the evidence (eg, history, physical examination findings, and results of diagnostic studies) support or fail to support the diagnosis as present in this person?
Causation Table 3-2

2. Review and assess the available epidemiologic evidence
   • What is the epidemiological evidence for the disease or condition?
   • Does quality data support a relationship with work or work activities?
   • To what extent is the condition idiopathic?
   • Is the prevalence/incidence in the general population KNOWN?
   • Answers to these questions are the focus of the “Blue Causation Book”

Causation Table 3-2

3. Obtain and assess the evidence of exposure
   • What evidence, predominantly objective, is there that the level of occupational environmental exposure (eg, frequency, intensity, and duration) could cause the disease?
   • See Table 3-3 Exposure Hierarchy
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

Causation Table 3-2

4. Consider other relevant factors
   • Are there individual risk factors other than the occupational environmental exposure that could contribute to the development of the disease?
   • For example, if the diagnosis is carpal tunnel syndrome, is the worker pregnant, obese, or diabetic?
   • In other words, use Table 3-1 Hill Criteria
### Causation Table 3-2

#### 4. Consider other relevant factors

- 2 of the 12 criteria in Table 3-1 do NOT require a knowledge of the medical literature
- **Temporality and Plausibility**

---

#### Causation Table 3-2

**4. Consider other relevant factors**

- Post hoc ergo propter hoc
- The rooster crows, then the sun rises.
- Perfect temporal correlation = Therefore, the rooster crowing CAUSES the sun to rise.
- **ERROR: “When” does not equal “Why”**
- “As I turned into the parking lot, my front wheel fell off on my 6 year old car; therefore, the store is liable for injuring my car.”
4. Consider other relevant factors-Plausibility

My hands go numb when I type on my keyboard. Therefore the keyboard is the cause for my carpal tunnel syndrome.

I have chest pain when I climb stairs. But, my coronary artery disease is the cause for my chest pain, not the stairs. This is why we do not call the chest pain, stair climbers disease.

5. Judge the validity

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
Causation Table 3-2

6. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation
   1. Form conclusions about the work-relatedness of the disease in the person undergoing evaluation – and also
   2. Understand of the legal threshold upon which your opinion must be based. (see chapter 2)

Causation Chapter 3 Summary

CORRELATION DOES NOT EQUAL CAUSATION.
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CORRELATION DOES NOT EQUAL CAUSATION.

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Chapter 4 Methodology

Quality Scoring Method for Epidemiological Studies
Step 1 = Thorough literature search Table 4-3
Step 2 = Determine study design Table 4-5
Step 3 = Rate article Table 4-4
Step 4 = Article quality x study design
Step 5 = Strength of evidence Table 4-7

If steps are followed, you will end up with Table 4-2, the Strength of Evidence Definitions
Chapter 4 Methodology

Table 4-3 Search Criteria

<table>
<thead>
<tr>
<th>Database</th>
<th>Terms of Search</th>
<th>No. Found</th>
<th>No. Reviewed in Detail</th>
<th>No. Accepted</th>
</tr>
</thead>
<tbody>
<tr>
<td>PubMed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AHRQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CINAHL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cochrane Register</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMBASE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EMB Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MEDLARS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: AHRQ, Agency for Healthcare Research and Quality; CINAHL, Cumulative Index of Nursing and Allied Health Literature; EMB is an evidence-based medicine database; EMBASE is a biomedical and pharmacological database; MEDLARS is used for preparing publications like Index Medicus®.

Table 4-4 Quality Scoring Scale

<table>
<thead>
<tr>
<th>Criteriа</th>
<th>Range of Score</th>
<th>Rating Anchor</th>
<th>Explanation of Rating Anchor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearly defined groups</td>
<td>0-10</td>
<td>0</td>
<td>Study lacks clearly defined groups or reports such groups, but subsequent analyses of data suggest groups were not clearly defined</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>Clearly defined groups mentioned, but descriptions imprecise or other questions about adequacy of study group identification cannot be adequately addressed</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td>Clearly defined groups specifically stated; reported data show well-defined groups</td>
</tr>
<tr>
<td>Exposure measurements</td>
<td>0-10</td>
<td>0</td>
<td>No mention of how exposures were measured</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>2.5</td>
<td>Exposure measurement by job classification or questionnaire given to subjects; air assessment methods</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>Measures objective and subjective measures and lack of clarity and completeness about how measures were done; individualized assessment required for rating of exposure</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>7.5</td>
<td>Measures mostly objective and individualized; few questions about how exposure assessments were accomplished</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td>Exposures objectively measured and individualized; exposure assessments well described</td>
</tr>
<tr>
<td>Participation and dropout rates</td>
<td>0-10</td>
<td>0</td>
<td>Participation rate less than 50% or not measured (for cohort studies, dropout rate of 40% or higher)</td>
</tr>
<tr>
<td></td>
<td>2.5</td>
<td>2.5</td>
<td>Participation rate of 50% to 90% (for cohort studies, dropout rate of more than 30%)</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>Participation rate 60% to 80% (for cohort studies, dropout rate of 20%–30%)</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>7.5</td>
<td>Participation rate 70% to 79% (for cohort studies, dropout rate of 10%–19%)</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>10</td>
<td>Participation rate of 80% or more (for cohort studies, dropout rate of less than 10%)</td>
</tr>
</tbody>
</table>
Chapter 4 Methodology

- Quality Scoring Scale of 0 to 140 multiplied by the Study Design below

### Table 4-5: Study Design Weighting Factors*

<table>
<thead>
<tr>
<th>Study Design</th>
<th>Weighting Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prospective cohort</td>
<td>1.0</td>
</tr>
<tr>
<td>Retrospective cohort</td>
<td>0.60</td>
</tr>
<tr>
<td>Case-control</td>
<td>0.30</td>
</tr>
<tr>
<td>Cross-sectional</td>
<td>0.15</td>
</tr>
<tr>
<td>Ecologic</td>
<td>0.05</td>
</tr>
</tbody>
</table>

**Table 4-7: Strength of Evidence of Causation in Epidemiologic Studies**

<table>
<thead>
<tr>
<th>Evidence</th>
<th>Point Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strong</td>
<td>&gt; 500</td>
</tr>
<tr>
<td>Strong</td>
<td>300-500</td>
</tr>
<tr>
<td>Some</td>
<td>100-299</td>
</tr>
<tr>
<td>Insufficient</td>
<td>&lt; 100</td>
</tr>
<tr>
<td>Conflicted</td>
<td>See conflicted evidence</td>
</tr>
<tr>
<td>Insufficient risk</td>
<td>See insufficient risk</td>
</tr>
</tbody>
</table>
### Chapter 4 Methodology

#### Table 4-2 Causation: Strength of Evidence Definitions

<table>
<thead>
<tr>
<th>Evidence Level</th>
<th>Definition</th>
<th>If Work Related, Threshold Is Reasonable Medical Probability or &gt; 50% Evidence Standard</th>
<th>If Work Related, Threshold Is Any Contribution, but Decision Is Evidence Based</th>
<th>If Apportionment of Risk Factor Creates Accepted Threshold, Making Case Legally Defined as Work Related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vary strong evidence (&gt; 500) or strong evidence (300-500)</td>
<td>At least 3 studies with sufficient methodological quality agree that the factor is a risk factor for the disease, and the relative risk is &gt; 2.0, and at least 2 high-quality prospective cohort studies agree</td>
<td>Yes</td>
<td>Yes</td>
<td>Likely large attributable proportion (&gt; 50%) for occupational causation assuming significant exposure of the individual and few nonoccupational risk factors present</td>
</tr>
<tr>
<td>Some evidence (100-299)</td>
<td>Does not qualify for &quot;strong evidence,&quot; yet at least 2 studies with sufficient methodological quality that generally agree that the factor is a risk factor for the disease, and the relative risk is &gt; 2.0, and at least 1 of the studies is a high-quality prospective cohort study</td>
<td>Possible, depending on the level of individual's work exposures and number and magnitude of nonoccupational risk factors present</td>
<td>Yes</td>
<td>Apportionment of &gt; 50% to the work exposure may or may not be opined depending on the magnitude(s) of individual's occupational exposures and number and magnitude of nonoccupational risk factors present</td>
</tr>
</tbody>
</table>

#### Evidence Level

<table>
<thead>
<tr>
<th>Evidence Level</th>
<th>Definition</th>
<th>If Work Related, Threshold Is Reasonable Medical Probability or &gt; 50% Evidence Standard</th>
<th>If Work Related, Threshold Is Any Contribution, but Decision Is Evidence Based</th>
<th>If Apportionment of Risk Factor Creates Accepted Threshold, Making Case Legally Defined as Work Related</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk evidence (usually 100-299, see relative risk)</td>
<td>At least 3 studies with sufficient methodological quality agree that the factor is a low risk for the disease, and the relative risk is &lt; 2.0, and at least 2 high-quality prospective cohort studies agree</td>
<td>No</td>
<td>Possible but unlikely. May be present if the individual had a major exposure to the factor</td>
<td>Minimal causation (much less than 50% of causation)</td>
</tr>
<tr>
<td>Insufficient evidence (&lt; 100)</td>
<td>Either no studies exist or a few studies exist, but, when the methodologically corrected evidence score is calculated, the score is &lt; 100 points, and thus additional studies are required before this potential risk factor can be evaluated</td>
<td>No</td>
<td>No</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Conflicted evidence</td>
<td>Studies of apparent equal methodological quality disagree on risk, and no conclusion is possible</td>
<td>No</td>
<td>No</td>
<td>Not applicable</td>
</tr>
<tr>
<td>No risk evidence</td>
<td>At least 3 studies with sufficient methodological quality agree that the factor is not a risk for the disease, and at least 2 high-quality prospective cohort studies agree</td>
<td>No</td>
<td>No</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Thank you!

Evaluation Reports vs. Evidenced Based Medicine
JUNE 7, 2016

RE: JOE vs. THE VOLCANO
CLAIMANT: JOE
CLAIM NO.: 123456
EAMS NO.: ADJ123456
EMPLOYER: THE VOLCANO
ACCT. NO.: 12345678-90
D/INJURY: CT 3/15/15 – 11/15/15
D/EXAMIN: 6/7/17

ORTHOPEDIC PANEL QME EVALUATION REPORT:

EMPLOYMENT AT TIME OF INCIDENT:
Joe worked as a packer for The Volcano for eight months. His job was to re-wrap and label gift boxes from China and put them into a box. The heaviest weight he lifted was 30 to 40 pounds. He stood all day long and lifted, but then states he occasionally knelt on the ground. He worked until he was laid off from his job.

HISTORY OF THE PRESENT INJURY:
Joe states he injured his low back and “hips” due to repeated lifting of boxes, beginning in about June, 2015. He also states he developed some left knee pain, “on and off”. He claims he reported this to his supervisor in September, 2015, but he was not sent for medical treatment and did not file any paperwork for a work injury.

After he was laid off, he sought the services of an attorney and was sent to Dr. Feelgood in January, 2016. To date, he has been treated with physical therapy, acupuncture, and medications.

CURRENT ORTHOPEDIC COMPLAINTS:
Low back pain radiating down his left lower extremity. When he talks about his hips, he actually points to the lumbosacral region. He reports some numbness at times into the left leg. He describes left knee pain, but this appears to be referred pain as he points to the back of the knee and thigh.

CURRENT JOB STATUS:
The patient is not working. He is collecting EDD State Disability. He last worked on 11/14/15.
PAST MEDICAL HISTORY:
WORK INJURIES:
Right shoulder injury in 2013 while working at The Greasy Spoon as a kitchen worker. He states he was off work for a short while and treated with acupuncture and shots. He states he still has occasional pain in his right shoulder. He admits to a settlement. He denied any low back pain from that injury.

REVIEW OF MEDICAL RECORDS:

DEPOSITION OF JOE:
Patient started working at The Volcano on 3/15/15. Patient testifies that he was completely pain-free and discomfort-free by the time he accepted his Award of $48,000.00 in August 2015. Upon further questioning, the patient states he actually traveled back to China three days after his last day of work and stayed in China for almost a month.

DISCUSSION:
Joe gives me a history of working for his employer for eight months and with the onset of lower back pain. He does have a prior work injury, but that apparently did not involve the lumbar spine or lower extremities, it involved only the shoulder and neck. Of some concern is the fact that he sought no care for his lumbar spine while working and admits he was able to work until he was laid off. He then went another six weeks before he sought medical attention. During that interim, according to his deposition he was able to travel to China. He admits in his deposition that he had increased leg pain when he returned from China.

STATUS:
The patient has reached maximum medical improvement.

AMA IMPAIRMENT:
Using the AMA Guides, 5th Edition:
For the lumbar spine the patient is a DRE lumbar category II, using Table 15-3, with a 6% whole person impairment.
CAUSATION & APPORTIONMENT:
Given the lifting and activities on his job, it is medically reasonable he may have had some lumbar spine pain due to his work. The radicular pain became worse when he traveled to China. There is no hip or leg injury. This is referred pain from the lumbar spine.

At this time, I would apportion the patient’s lumbosacral spine disability 60% to his work at The Volcano and 40% to the increased injury when he traveled to China when he lost his job. His history in the deposition of the radicular pain increasing with the China trip cannot be ignored.

This report was signed electronically on this day in Los Angeles.
Respectfully,

Albert Schweitzer IV, M.D.

AS/cm
cc: Law Offices of Allweiss and McMurtry
    Law Offices of Dewy, Cheetum & How

Deposition of ALBERT SCHWEITZER IV, M.D., Volume I, taken before Mickey Mouse, Certified Shorthand Reporter for the State of California, commencing at 1:00 P.M., Tuesday, January 17, 2017, at the offices of Allweiss & McMurtry, 18321 Ventura Boulevard, Suite 500, Tarzana, California.

APPEARANCES OF COUNSEL:
FOR THE APPLICANT:
Law Offices of Dewy, Cheetum & How
By: Max Cheetum, Attorney at Law
    1000 North Broadway
    Los Angeles, CA 90019
    (323) 555-5554

FOR THE DEFENDANT:
Law Offices of Allweiss & McMurtry
By: Saul Allweiss, Attorney at Law
    18321 Ventura Boulevard, Suite 500
    Tarzana, CA 91356
    (818) 343-7509
Q: So doctor, you concluded that 60% of the causation of the applicant’s injury was due to the repetitive work at The Volcano, is that correct?

A: Yes.

Q: Doctor, how did you reach that conclusion that the work place caused Joe’s back injury despite the fact that he settled a cumulative trauma claim just a few months before he stopped working for The Volcano and asserted that he was pain free, in regard to his lumbar spine, when he started working for The Volcano, further noting that in his deposition the applicant freely admits that he could have continued working, but for being terminated from The Volcano and, lastly, noting that the applicant was able to undertake a trip to China immediately after the end of his employment at The Volcano?

A: Well, I still feel that the repetitive nature of the applicant’s job duties had something to do with his back pain.

Q: Doctor, do you have any type of evidence to back up your opinions?

A: I based my opinions on my years of experience doing these types of evaluations and it is a commonly accepted fact that repetitive job duties can cause a low back injury.

---

Q: Doctor, have you ever referred to any treatises that would provide you with assistance in regard to the causation of injury in the workplace?

A: No, I just apply my years of experience and common sense.

Q: Doctor, have you ever utilized the treatise known as the AMA Guides to the Evaluation of Disease and Injury Causation, Second Edition?

A: Oh, you are referring to the AMA Guides [referring to a copy of the AMA Guides to the Evaluation of Permanent Impairment, Fifth Edition]?

Q: No doctor, I am referring to a totally different book and I will show you a copy of it that I brought with me here to the deposition. Have you ever seen this book?

A: No.

Q: Doctor, I would like you to read pages 200 and 201 of this treatise at this time.

[There was a brief recess.]
[Back on record.]

Q: So doctor, have you had a chance to read pages 200 and 201?
A: Yes.

Q: Doctor, turning to the last sentence of page 201 that reads “there is insufficient evidence for heavy work as a risk factor for low back pain”. In light of what you just read, doctor, does that alter your opinions in any way in regard to your opinions pertaining to the causation of the applicant’s low back pain being associated with the workplace?

A: No, as I said before, all my years of experience and common sense is what I use to guide me in making these decisions but, this is an interesting book and I think I should read it sometime.

[The court reporter notes Mr. Allweiss to be gnashing his teeth and audibly sobbing in frustration.]

AMA Guides to Evaluation of Disease and Injury Causation States:

**Activity Factors**

**Heavy Physical Work**

The prospective cohort studies that examined heavy physical work included lifting, pushing, pulling, annual handling of materials, and construction tasks. A variety of exposures were reported, and most were not statistically significant with respect to the incidence of low back pain or work absence. Hui and Roffey, in their systematic reviews, emphasized the complexity of these tasks and noted that many studies did not adequately adjust for confounding factors, nor did they differentiate specific subcategories of specific activities. Furthermore, there were a variety of measured outcomes, including new onset low back pain, recurrent low back pain, and risk of sickness absence.

Health care workers were examined in a distinct group in a number of studies. Activities considered also included lifting or carrying loads and transferring patients.
AMA Guides to Evaluation of Disease and Injury Causation States:

In a prospective cohort study that measured isokinetic lifting strength and evaluated workers' balance between physical capacity and loads, a borderline statistically significant association was noted for the "low balance" group consisting of workers with lower than median physical exposure and lower than median physical capacity. In the majority of cases, there was no association regardless of the workers' physical capacity (high or low) or exposure (high or low). There was no statistically significant relationship between low back pain in workers and lifting or carrying with 1 hand or 2 hands.

Lifting greater than 25 lbs at or above shoulder level was a weak predictor (OR 1.8, 95% CI 0.9-3.3) of new onset low back pain. In this same study, no statistically significant association was identified between lifting with 1 hand, lifting with 2 hands, or carrying weight on 1 shoulder. Hoogendoorn demonstrated an increase in low back pain with more than 15 lifts of 25 lbs or greater in the working day (RR 1.62, 95% CI 0.97-2.69).

A number of studies reported no statistically significant associations between heavy physical work and low back pain. Many of the associations that were noted were weak. The statistically significant associations were limited to high manual handling of materials in scaffolders and lifting and standing in smokers.

In the studies that examined health care workers specifically, lifting, carrying, and pushing heavy objects at work more than 5 times in an average shift predicted sick leave longer than 8 weeks attributed to low back pain. In that same study, there was a statistically significant association between a medium level of quantitative work demands and sick leave exceeding 3 days; however, no dose-related response was observed. Another study found that when low back pain was the outcome, there was a mild exposure response trend for manual transfer of patients and manual moving of patients, although the odds ratios were only weakly statistically significant. Yip found that assisting patients while ambulating was associated with new low back pain in nurses. Patient mobility is a factor in all of the nursing tasks considered and affects the ability to distinguish the contributions of specific tasks to risks.

There is insufficient evidence for heavy work as a risk factor for low back pain (Table 8-12).
EMPLOYMENT AT TIME OF INCIDENT:

Abe worked as a data entry worker from 1994 to 2003 and as an office manager from 2003 to 2010 for Lincoln Auto. His duties were typing, filing, lifting, and moving boxes of files from the floor to storage. She performs constant sitting, bending at the neck, twisting at the neck and waist, simple grasping and power grasping. He constantly pushes and pulls with the right hand and performs fine manipulation. He performs reaching below the shoulder level primarily but occasionally reaches above the shoulder level. He performs lifting and carrying between 11 to 25 pounds maximum.
HISTORY OF THE PRESENT INJURY:

Abe definitely sustained injuries to his neck, mid back, lower back, both shoulders, elbows, wrists, and hands, as well as both knees and right ankle in the course of his employment working for Lincoln Auto.

Abe sustained injuries to the above noted areas as a result of performing repetitive activities including typing, picking up boxes, lifting heavy boxes, sweeping, mopping, filing, cleaning restroom, cleaning office, dusting, always having his neck down, repeated motions, and prolonged sitting.

He states that he first began to notice pain in his neck and left shoulder in 1998, to his mid and low back as well as wrists in 2005, and to both knees and both elbows in 2009. He also developed pain in his right ankle in 2010.

CURRENT ORTHOPEDIC COMPLAINTS:

The patient describes mild-to-moderate pain, which becomes severe at times for the cervical spine with flexion, extension, rotation, and prolonged positions for the head and neck.

The patient describes intermittent moderate pain becoming severe at times for the thoracic and lumbar region increased with sitting, standing, and walking for prolonged period of time. He describes constant moderate pain in both shoulders that is increased with reaching, lifting, pushing, and pulling.

He describes constant moderate pain in both wrists and both thumbs increased with gripping, grasping, torqueing, lifting, pushing, pulling, and manipulative activities.

He describes pain for both his knees that is increased with walking, standing, climbing, and squatting. He also describes intermittent moderate pain in his right ankle increased with prolonged standing and walking.

He describes numbness and tingling for both hands to all fingers and numbness and tingling in the lower extremities extending down to his feet.
**CURRENT JOB STATUS:**
The patient is not working. He is collecting EDD State Disability. He last worked on 11/14/15.

**PAST MEDICAL HISTORY:**
Patient indicates prior injury to the neck in approximately 2000. He recalls receiving some sort of physical therapy, but does not remember the events surrounding this injury.

He denies subsequent injuries or other work-related injuries.

He states he was in a motor vehicle accident in 2000 which made his neck worse. He also states that he was involved in a motor vehicle accident in 2011, which involved a chest injury.

**MEDICATIONS:**
The patient is taking clonidine, terbinafine, hydrochlorothiazide, Janumet, Vytorin, hydrocodone, gabapentin, omeprazole, zolpidem, amoxicillin, tamoxifen, sertraline, and takes insulin as well.

**DIAGNOSIS**
1. Cervical Strain
2. Lumbar Strain
3. Thoracic sprain
5. Lateral epicondylitis, bilateral elbows.
6. Carpal tunnel syndrome, both wrists.
7. De Quervan’s tenosynovitis right wrist.
8. Bilateral Knee Pain.

**DISCUSSION:**
Abe provided a long time history of working for Lincoln Auto as a data entry clerk with different dates of onset for his particular injuries. He describes constantly sitting and using both arms for pulling, pushing, and fine manipulation. He also was constantly twisting and bending his neck to view multiple monitors and supervise other employees.

He has not been able to return to the workforce since 2012, since which he has received physical therapy and medications.
CAUSATION:
Based on the information available, causation is considered industrial for the cervical spine, shoulders, and bilateral upper extremity conditions. The mechanism of injury as described by the patient is consistent with development of symptoms for these areas. He performed repetitive use of his hands and upper extremities and performed prolonged seated activities, which would be consistent with development of the symptoms for the cervical spine, shoulders, and upper extremities.

With respect to the claim for thoracic spine, lumbar spine, both knees, and right ankle, the patient performed a rather sedentary type of job without significant physical activity or effort. He did not perform significant climbing, squatting, walking, and standing activities, which may develop symptoms for the lower extremities. Therefore, the condition for the thoracic spine, lumbar spine, both knees, and right ankle are not considered industrially related.

STATUS:
The patient is not yet maximally medically improved. Further diagnostic testing is needed in order to assess the severity of his conditions and indication of treatment necessary for his improvement.

Thank you for the opportunity to evaluate this examinee. If I may be of additional assistance, please correspond with me, in writing.

All recommendations are in this report are based upon medically reasonable treatment plan which is consistent with the standards set forth in the American College of Occupational and Environmental Medicine/Occupational Guidelines second edition and/or evidence based studies.

Respectfully,

Schmarlez Schmarz, M.D.
AMA Guides to Evaluation of Disease and Injury Causation States:

Sedentary Work, Repetitive Work, and Precision Work

Ariens’ noted that several literature reviews considered work-related physical risk factors for the development of neck pain with some inconsistencies related to study design. However, there seemed to be a consensus that static postures, neck flexion, repetitive arm use, and sitting were potentially the main physical risk factors. Neck flexion and rotation were not statistically significantly associated with neck pain, even for longer periods of time. Work with hands above the shoulders was not associated with either incidence or recurrence of neck pain in the study of nursing-home and elderly-care workers by Luime. Prolonged work in a sedentary position, including use of a mouse or keyboard, had a dose-related association with neck pain in 2 studies. Those who worked in a sitting position for more than 95% of the time were at a statistically significant risk for increased neck pain with a RR of 2.34 (95% CI 1.05-5.21) in the Ariens study. Work with a mouse more than 30 hours per week was also statistically significantly associated with neck pain in 1 study, although the same association was not noted with keyboard use. The authors noted that their data did not support a threshold above which an increasing effect could be anticipated.

Jensen found no association between work time or using a mouse, and Luime found only a weak relationship between prolonged work in the same position and the onset of neck pain but not the recurrence. In 3 other studies, no significant association was identified for repetitive work or with use of a mouse.

<table>
<thead>
<tr>
<th>Work time at a computer</th>
<th>OR</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>1.0</td>
</tr>
<tr>
<td>50%</td>
<td>1.5 (0.7-3.1)</td>
</tr>
<tr>
<td>75%</td>
<td>1.3 (0.6-2.7)</td>
</tr>
<tr>
<td>100%</td>
<td>1.6 (0.8-3.3)</td>
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</table>


Prospective cohort where the duration of computer work was not significantly associated with neck symptoms.

AMA Guides to Evaluation of Disease and Injury Causation States:

Occupational Risk Factors for de Quervain’s disease

- Combination of risk factors (eg, force and repetition, force and posture): some evidence
- Vibration: insufficient evidence
- Highly repetitive work alone or in combination with other factors: some evidence
- Forceful work: some evidence
- Awkward postures: low risk evidence
- Keyboard activities: low risk evidence
- Cold environment: insufficient evidence
- Length of employment: insufficient evidence (trend of increased incidence if on job less than 3 years)

Again, as outlined in Chapter 4, LOW RISK evidence is defined as a potential risk factor that is possible if the individual had a major exposure but for which there is not enough scientific evidence to establish risk. In other words, low risk evidence is unlikely to be a risk factor using the criteria of “more likely than not” (minimal causation = much less than 50% of causation).

Kay’s conclusion was, “Thus, there is no validated evidence for the view that de Quervain’s disease is caused by work. However, there can be little doubt that in patients who develop de Quervain’s disease, use of the hand will be painful. As previously noted, de Quervain’s disease is a true tenovaginitis and it is not difficult to understand that the movement of the tendons through the stenosed sheath will be painful, but there is no clinical evidence to support the view that the use of the hand alters the natural history of the condition in any way.
### AMA Guides to Evaluation of Disease and Injury Causation States:

#### Painful Elbow—Lateral and Medial Epicondylitis

**Occupational Risk Factors for Painful Elbow**

- Combination of risk factors (e.g., force and repetition, force and posture): strong evidence
- Vibration: insufficient evidence
- Highly repetitive work alone or in combination with other factors: insufficient evidence
- Forceful work: low risk evidence
- Awkward postures: low risk evidence
- Keyboard activities: insufficient evidence
- Cold environment: insufficient evidence
- Length of employment: insufficient evidence

Keyboard activities | Insufficient evidence. However, the symptoms may persist longer in keyboard workers who have previously developed tennis elbow from some other cause.219

#### Median Nerve Entrapment at the Wrist (Carpal Tunnel Syndrome)

**Occupational Risk Factors for Median Nerve Entrapment at the Wrist**

- Combination of risk factors (e.g., force and repetition, force and posture): very strong evidence; national and international epidemiologic surveillance data has consistently demonstrated that the highest rates of CTS occur in occupations with high upper-extremity physical demands, including meatpacking, poultry processing, automobile assembly work, and other occupations requiring intensive manual exertion of distal upper limbs
- Vibration: low risk evidence
- Highly repetitive work alone: conflicting evidence; widely varied definitions for repetitive work, making association difficult
- Highly repetitive work or in combination with other factors: strong evidence; but again the widely varying definitions for repetitive work makes association difficult
- Forceful work: very strong evidence
- Awkward postures: low risk evidence; the lack of evidence is possibly due to individual variability in work methods among those in similar jobs and differing body posture while measuring postural characteristics of jobs; there is some evidence of postural factors in laboratory-based studies of extreme postures

Keyboard activities | Insufficient evidence. No association for keyboard risk206,264 keyboard not a risk factor;259 no trend for risk to increase with more time spent keyboarding;269 no evidence on keyboard and computer work;261 keyboard not a risk factor;209,210,212,213 no effect of typing;209 no effect from keyboard redesign.219 A meta-analysis found no support for CTS risk with use of the computer keyboard or mouse.219 Other studies demonstrated no associations.206,207,209
Confounders
An individual who says “My job caused my carpal tunnel” may be correct if the job title is chainsaw logger or stone quarry drill operator and job activities require a minimum of 8 hours of chainsaw or stone drill use per day at least 20 hours per week. This also applies to those who have undertaken such work for at least 12 months in aggregate in the 24 months prior to the onset of symptoms.

A prospective cohort study of 536 workers at 10 diverse manufacturing facilities reported univariate hazard ratios for TULV for HAI and SI for aerobics, baseball, basketball, bicycling, American football, motocrossing, piano, racquetball, remodeling, running, snowmobiling, snow shoveling, snow skiing, swimming, tennis, use of vibrating tools outside of work, water skiing, weightlifting, and woodworking.235 It showed no statistically significant increased risk of CTS for these activities but did for gardening (HR 3.05; 95% CI 1.28-7.25). This may represent the problem of false positive findings in studies that analyze multiple subgroups. The more potential risk factors analyzed, the more likely it is that at least 1 false positive association will be found.239

Another meta-analysis of 64 articles concluded that, except for work that involves very cold temperatures (possibly in conjunction with load and repetition) such as butchery, occupational activities are less likely than demographic and disease-related variables to cause CTS. The authors concluded that to label other types of work as having caused CTS would result in inappropriate allocation of resources. It would also relieve individuals of the responsibility of addressing correctable lifestyle factors such as smoking and high alcohol intake and treatable illnesses such as obesity and diabetes, which may have contributed more to their CTS than work.360

In summary, determining the role of any given risk factor in causation of carpal tunnel syndrome is extremely difficult. If a physician is treating a man with hypertension, hypercholesterolemia, diabetes, a sedentary lifestyle, and a long history of smoking, when that man has a heart attack and asks, “Doc, did my smoking cause my heart attack?” there is no easy answer. Answering, “Did my job cause my carpal tunnel syndrome?” is equally challenging, and the scientific studies on coronary disease risk factors are more numerous and more methodologically sound than the studies on CTS risk factors.