Use of Assessment Tools within Ergonomic Programs

Objectives

- Students will understand the approach and assumptions of each type of decision-making system.
- Students will understand the relative benefits of each type of system.
- Students will understand the limitations and practical applications of each approach.

Statistics 101

- Types of validity and why we care.
  - Face validity
    - (Does it seem to make sense)
  - Content Validity
    - (Are we looking at the big picture)
  - Construct Validity (Are the scores meaningful?)
  - Internal Validity (Is there a cause and effect)
  - External Validity (Are results transferable)
  - Statistical Conclusion Validity (Is the data set big enough?)
  - Criterion Related Validity (Are results predictive?)
Statistics 101

Types of Reliability and why we care.
- Test-retest (The same test over time)
- Interrater (Between different raters)
- Parallel forms (Results between related tests)
- Internal consistency (Items within the test)

Error measurements

A Bar Plot with Error Bars

Significant Figures

- $1.234 \times 2 = 2.468 \approx 2$
- $1.234 \times 2.0 = 2.468 \approx 2.5$
- $0.01234 \times 2 = 0.02468 \approx 0.02$

Error multiply with each additional measurement.
Reduce Injuries, Reduce Costs, Increase Worker Safety

Primary Risk factors and Secondary
- Force
- Repetition
- Contract pressure
- Vibration
- Heat/cold
- Posture
- Acceleration
- Static contraction vs recovery
- Overtime
- Sense of control
- Turn over
- General health of workers
- Work and general stress
- Chemical exposure
- Demographics

Noise vs Signal
This slide shows the number of injuries due to a batch of slightly faulty parts received from a subcontractor every other Monday.

Total Trend
Composite including increased reports on Mondays, biweekly on boarding, periodic overtime and random occurrences.
Reduce Injuries, Reduce Costs, Increase Worker Safety

This slide shows the number of injuries due to all the factors discussed, compared to a 90% reduction in injuries due to an Ergonomics first aid program being implemented.

Reduce Injuries, Reduce Costs, Increase Worker Safety

Comparison

Ergonomic Tools

- Historical
- Use of Experts
- Expert tools
- Surveillance tools
- AI
- Visual or sensing device tracking
- Squeaky wheel

Reduce Injuries, Reduce Costs, Increase Worker Safety
### Historical Analysis

- Should be part of any program
- By nature is reactive
- Discounts natural variation
- Easy to confuse causation with symptomatic response.
- Requires a high level of data for good decision making.

### Expert Opinion

- Validity is based on the strength of the opinion.
- Reliability is dependent on experience.
- Can include all primary and secondary factors.
- Has high legal defensibility.

**TX IS EASY DX IS HARD**

### Ergonomic Expert Tools

- Modeling and simulation require expert knowledge to use tools and interpret results.
- Provide more clarity in understanding risk or worker capabilities.
- Need to have some sense of risk type in order to justify the assessment method.
- Used in the design of work and injury management.
Reduce Injuries, Reduce Costs, Increase Worker Safety

**Expert System**
- NIOSH WPG
- 3 Dimension Static Strength Models
- Strain Index
- Snooks Data Tables
- Pick the correct tool
- Understand the limitations
- Thoughtful interpretation

**Surveillance Tools**
- Get you in the ballpark
  - Introduces general ergonomic principles
  - Creates a consistent methodology
  - Limits dependency on expert knowledge
  - Provide a score and threshold
- Where they fall flat
  - Tend to be overly dependent upon posture
  - Specious linking of risk factors
  - Tend to be unfocused
  - Tend to lack inter-rater reliability
  - Tend to lack predictive validity

**Surveillance Tools**
- Simple to use with limited input choices.
- Ask the important questions
- Score body parts individually
- Be upward compatible.
- Be part of a decision making hierarchy.
- To the extent possible be based on peer review science.
ErgoFocus Simplicity

- Accessible via the Ergonomic Corollary feature of ErgoFactor®
- Simple 'Yes/No' question framework
  - Limited to a mere 20 questions
  - Answering 'Yes' poses an even 1 to 5 inputs
- Uses simple to understand language, fields, and graphics to set input values
  - Forces or weights estimates entered as simple integer values
  - Busyness/repetitiveness is selectable in 5 discrete values
  - Frequency is selectable in 4 discrete values
  - Postures typically defined in graphical buttons
- Additional assistance is provided in hover-over help

Artificial Intelligence

Active Learning Cycle has six steps

1. Training Data. An ML model must have data to train on.
2. Build ML Model. The model is created.
3. Model Predictions. The model makes predictions.
4. Feedback. The model gets feedback on its predictions from human or environmental stimuli.
5. Feedback becomes data. Feedback is submitted back to a data repository.
6. Repeat Step 1. Continue to iterate on this cycle.
Reduce Injuries, Reduce Costs, Increase Worker Safety

Limitations to Artificial Intelligence

- Requires a large and consistent data set.
- Often has built-in biases based on data structure.
- Difficult to impossible to track the logic.
- Limited by the data sets.

Take Aways

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<th>Facility Need</th>
<th>Recommend Approach</th>
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<tbody>
<tr>
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<td>Surveillance</td>
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<td>Areas of rapid change</td>
<td>Surveillance</td>
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<tr>
<td>International</td>
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<td>Injury optimization</td>
<td>Expert/Expert Tool with integrated demand analysis</td>
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<td>High risk/cost</td>
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<td>System integration</td>
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<td>Administrative Ergonomics</td>
<td>Full JA plus Surveillance and expert</td>
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<td>Large company with good data</td>
<td>Consider AI solutions</td>
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<td>management</td>
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Tiered Approach to Ergonomics

Reduce Injuries, Reduce Costs, Increase Worker Safety
ErgoFactor Mission Statement

Our mission is to:

- **REDUCE** Injuries
- **REDUCE** Costs
- **INCREASE** Worker Safety

Questions?
Thank you!

www.ergofactor.com