Respirator Tolerance

PHILIP HARBER MD MPH
UCLA
WILL RESPIRATORS BE EFFECTIVE?

• DEVICE MUST EFFECTIVELY SUPPLY CLEAN ENOUGH AIR

• DEVICE MUST BE USED WHEN AND WHERE NEEDED
QUESTIONS:

• CAN WORK CONTINUE IF WIDESPREAD USE IS NEEDED?
• CAN PERSONS WITH MILD RESPIRATORY DISEASES USE THEM?
• HOW DO 2 COMMON TYPES COMPARE?
• WHAT IS BEST MEASURE OF “PUBLIC HEALTH” EFFICACY?
TWO APPROACHES:

• DECISION ANALYSIS
• EXPERIMENTAL
**DECISION ANALYSIS:**

- Define key factors & “typical” values
- Estimate # of persons overexposed
- Determine impact of incremental improvement of 1 factor on # overexposed

<table>
<thead>
<tr>
<th>RESPIRATOR</th>
<th>PF</th>
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<tbody>
<tr>
<td>WPF</td>
<td></td>
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<tr>
<td>SITES</td>
<td>NUMBER OF SITES</td>
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<tr>
<td>WORKERS/SITE</td>
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<td>PROGRAM</td>
<td>PROPER SELECTION</td>
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<tr>
<td>PERSON</td>
<td>EVER USES</td>
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<tr>
<td>PERSON</td>
<td>PROPORTION OF TIMES USED</td>
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<tr>
<td>EXPOSURE</td>
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<td>TYPICAL HAZARD LEVEL</td>
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<tr>
<td>VARIABILITY</td>
<td>% OUTLIERS</td>
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<tr>
<td>RESULTS</td>
<td>NO. ABOVE HAZARD LEVEL</td>
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<tr>
<td>RESULTS</td>
<td>DIFFERENCE</td>
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PUBLIC HEALTH: IMPROVE USER %

EFFECT OF CHANGE IN FACTOR TO OVEREXPOSED # (MOD RISK)

- Typical: 56,145
- ↑ WPF: 55,883
- ↑ % Ever Users: 53,708
- ↑ % Proper Use: 46,492
- Sensitive - outlier: 60,530
- Low WPF - outlier: 56,413
EXPERIMENTAL
EXPERIMENTAL APPROACH

• COMPARE 2 RESPIRATOR TYPES AND LABORATORY SURROGATES
  ► N95 ► DUAL CARTRIDGE HALF MASK (HFM) ► INDIVIDUAL LOADS

• IN 4 USER GROUPS: NORMAL, COPD, RHINITIS, ASTHMA

• WITH SIMULATED WORK & IN LAB
OUTCOME MEASURES

- PHYSIOLOGIC RESPONSE
- PHYSIOLOGIC ADAPTATION
- WORK PRODUCTIVITY
- MASK POSITION MOVEMENT
- SUBJECTIVE RESPONSES (12)
HOW SHOULD SUBJECTIVE RESPONSE BE MEASURED?

• ONE QUESTION IS NOT ENOUGH: MULTIPLE SUBJECTIVE RESPONSES MUST BE MEASURED

• 3 DISTINCT GROUPINGS OF RESPONSES: "PHYSIOLOGIC SENSATION", "FUNCTIONAL IMPACT", "MINIMAL"
HOW SHOULD PHYSIOLOGIC RESPONSE BE MEASURED?

- ADAPTATION OF RESPIRATORY PATTERN IS THE MOST CONSISTENT EFFECT
HOW DO THE 2 RESPIRATOR TYPES COMPARE?

• HFM PRODUCED MORE ADVERSE SUBJECTIVE RESPONSE ON MULTIPLE SCALES

• HFM PRODUCED GREATER PHYSIOLOGIC ADAPTATION IMPACT (ALBEIT LIMITED IN MAGNITUDE)
IMPLICATIONS:

• BOTH THE DECISION ANALYSIS AND EXPERIMENTAL APPROACHES SUGGEST:

• THERE IS A "TRADE-OFF" BETWEEN RESPIRATOR PROTECTION FACTOR AND PROTECTION OF WORKERS! I.E., HIGHLY PROTECTIVE RESPIRATORS THAT ARE NOT USED MAY ACTUALLY BE LESS PROTECTIVE TO PUBLIC HEALTH THAN LESS EFFECTIVE DEVICES THAT FAR BETTER TOLERATED & MORE WIDELY AVAILABLE

• SINCE WE DO NOT (YET) KNOW WHICH OUTCOMES ARE MOST IMPORTANT, RESPIRATOR DESIGN & EVALUATION SHOULD CONSIDER MULTIPLE DOMAINS: ► (PHYSIOLOGIC IMPACT, ► RESPIRATORY ADAPTATION, ► MULTIPLE SUBJECTIVE COMPONENTS, ► WORK PRODUCTIVITY, & ► ACTUAL UTILIZATION)
THANK YOU!