Learning objectives

1. Understand the role of proper indoor humidification in improving health, learning and productivity
2. Understand that proper indoor humidification is an effective intervention to decrease seasonal influenza illness
3. Understand the design of an energy-saving humidification system for health-care applications
4. Understand how to estimate the ROI break-even point of the most common steam and adiabatic humidification systems

Acknowledgements

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Thank you to Condair for the pro bono humidification equipment for the Phase II study, in progress

Summary outline

Background
- Hospital study in 2014

Multiple studies create a knowledge base
- New data on IAQ and elderly patients
- New data on IAQ and pathogens

Conclusions and next steps
- Pathogen infectivity
- Human health

Hospitalization is the third leading cause of death in the US!
- Healthcare Associated Infections (HAIs) are the main cause.
- How is the hospital building involved in this sad statistic?

2014 Hospital Study: Do Building Design And Operation Support Human Health?

10 patient rooms were monitored over 12 months
Respiratory and gastro-intestinal infection rates were lowest at indoor RH 40−60%

Non-infectious adverse patient events trended lower when RH 40−60%

Independent group t-test - all patient events and RH

<table>
<thead>
<tr>
<th>Event</th>
<th>RH &lt;40% (SD)</th>
<th>40−60% (SD)</th>
<th>RH &gt;60% (SD)</th>
<th>T-test comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td>Falls</td>
<td>49.0 (15.7)</td>
<td>41.5 (14.26)</td>
<td>29.2 (9.26)</td>
<td>1.78 (0.28)</td>
</tr>
<tr>
<td>PRN antipsychotic medication</td>
<td>7.98 (6.00)</td>
<td>3.74 (4.45)</td>
<td>2.90 (6.32)</td>
<td>-0.98 (0.55)</td>
</tr>
<tr>
<td>Pressure ulcer</td>
<td>4.67 (4.04)</td>
<td>1.73 (1.30)</td>
<td>2.40 (0.90)</td>
<td>1.92 (0.38)</td>
</tr>
<tr>
<td>Urinary tract infections</td>
<td>2.20 (5.7)</td>
<td>3.04 (2.36)</td>
<td>2.06 (1.67)</td>
<td>0.37 (0.12)</td>
</tr>
<tr>
<td>Gastrointestinal infections</td>
<td>3.13 (2.56)</td>
<td>0.75 (0.79)</td>
<td>3.90 (1.30)</td>
<td>3.56 (0.03)</td>
</tr>
<tr>
<td>Cubital</td>
<td>2.17 (1.49)</td>
<td>1.80 (1.62)</td>
<td>0.69 (0.73)</td>
<td>1.47 (0.58)</td>
</tr>
</tbody>
</table>

Month incidences rate

Model estimates:

\[ y = 0.0038x^2 - 0.3562x + 8.2965 \]

\[ R^2 = 0.6348 \]

\[ y = 0.0037x^2 - 0.3784x + 9.2972 \]

\[ R^2 = 0.7775 \]
2018: Humidity As A Non-pharmaceutical Intervention For Influenza A

Next presentation

Conclusions

- Temperature: 22 – 26°C depending on the season
- Relative humidity: 40 – 60% rH
- CO₂-level: < 800 ppm

Indoor Climate – Conquerer of the students?

Matura presentation
Eric Zimmermann, G4f
Supervision: Marius Boner, Martin Speck

Infectious Droplets Shrink And Travel Far In Dry Air

Student performance in relation to classroom RH

Rh Of 40% Inactivates 80% Airborne Influenza A
This Is New and Startling Data...

"Antibiotic Resistance Can Spread Through The Air, Scientists Warn, And Yes You Should Be Terrified"
July 26, 2018

Dry conditions increase horizontal transfer of antibiotic resistance genes

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1985 ASHRAE Sterling et al., Optimum relative humidity ranges for health = 40%–60%

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Conclusions

This four-year study shows that indoor relative humidity between 40–60% is correlated with decreased viral and bacterial infections and trended with improved cognitive functioning in elderly patients in residential care.

Maintaining adequate indoor air humidification is an under-utilized tool which effectively decreases the transmission of infectious organisms both known to be airborne, and those thought to travel primarily through contact transmission.

With proper building design, balanced indoor humidification is a very cost-effective strategy to improve the health and cognitive functioning of all building occupants.

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Bibliography

Questions?

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