Seminar 21 - Putting People First: The Healing Power of Indoor Air

Putting Patients First: Operating and Intensive Care Room Hospital Acquired Infection Prevention Safety Surveillance System

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The Overall session learning objectives are:

• Provide a data-driven description of indoor environmental factors that are associated with occupant health, including patient safety
• Explain the application of energy-saving and hygienic approaches to active humidification when supplementation is necessary as an intervention for dry air
• Provide building owners a cost-benefit analysis of occupant health as a building performance metric
• Identify the relationship between water in the liquid and vapor state and the human body
Potential Source Bias Declaration & Acknowledgements
Cross Functional Teamwork Leaders – Admin, Clinical, Infection Prevention, Safety, Quality, D&C, EVS, Facilities

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Distinguished Lecturer for ASHRAE

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Dr. Jennifer Wagner and Damon Greeley are co-inventors of an operating room monitoring algorithm to predict risk of microbial contamination
Contaminated Operating & Procedure Rooms in the News

• LA County-USC
• Seattle Children’s
• State of Colorado – Surgical Smoke Cessation
• Lint Leading to Blood Clots
• Disposable Attire
Helping Improve the Environment for Patients, Staff, and the Planet

- Harvard BJ
- Airflow and air exchanger studies for 15, 20, and 25

<table>
<thead>
<tr>
<th>Building Utility Service Type &amp; Climate Zone</th>
<th>Annual Energy Savings per 2 ACPH Reduction*</th>
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</thead>
<tbody>
<tr>
<td>City Thermal Utilities Climate Zone 5</td>
<td>$4,027</td>
</tr>
<tr>
<td>Campus Thermal Climate Zone 4</td>
<td>$2,820</td>
</tr>
<tr>
<td>Self-Generated Thermal Climate Zone 4</td>
<td>$2,087</td>
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</tbody>
</table>

*Energy calculations were based upon ~ 20 ACPH for a 550 SF operating room that included electrical energy from fans, pumps, cooling systems, thermal energy for preheating and terminal unit reheating, and steam humidification. The model also included the appropriate seasonal utilization hours for cooling, heating, economizer, and dehumidification/sub cooling modes of operation. The air handling system was ~40% outdoor air.
Patient Safety and Quality Improvement Act of 2005

To encourage hospitals to pursue safety research, The Patient Safety and Quality Improvement Act of 2005 was passed. This act established a network of patient safety organizations and a national patient safety database. To encourage reporting and peer-review of adverse events, near misses, and dangerous conditions, it also established federal confidentiality protection from legal discovery of patient data collected as part of hospital efforts to assess and resolve patient safety issues. *Hospital data collected in order to reduce medical errors and improve patient safety continues to be generally exempt from legal exposure.*
Where Do Operating Rooms Particulate Levels Rank on ISO Cleanliness?

- ISO 1
- ISO 5-6
- ISO 7-9
- ISO 9

Can’t Be Measured

500,000+
500,000,000+
How Often Do Facilities Comply?

ISO 5-6
500,000+

ISO 7-9
500,000,000+

> 95%

< 40%
Evaluation of Independent Pressure Control vs. PID Loop Control for Critical Rooms In-Activity

1. Venturi valve – Std Dev 0.00” w.c., Avg. 0.01” w.c.
2. Control Exh/Ret Damper or CV – Std Dev 0.01” w.c., Avg. 0.02” w.c.
3. Typical OR needs 2 additional ACPH to achieve 0.01” w.c. greater pressure to account for variability (Std Dev) associated with pressure control method #2.

Pressure Trend from BMS
Environmental Quality Index (EQI)
Continuous Environmental Monitoring
Voice User Interface Design – ‘Smarter’ & Safer Operating Room In Development

Dr. Smith: “\textbf{Computer, what is my next case recommended EQI level?}”

Computer: “\textbf{Hello Dr. Smith, your next primary procedure is a kidney donor laparoscopic. Your recommended maximum EQI level is 1. Are you ready to proceed?”}
Hospital Acquired Infections (HAI) – Risk Picture and Antibiotics

1. Our clients **holistic risk picture is complicated**
   A. Need to gather and correlate data to develop risk **predictors** by OR according to previous adverse events.

2. Continue to validate the efficacy of the risk **predictors** which is especially important as we enter a **post-antibiotic era**.

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Each source is a potential entry point for microbial contamination.

- Facility
- Equipment
- Process
- Materials
- Utilities
- Personnel

Skin
- Subcutaneous tissue
- Deep soft tissue (fascia & muscle)
- Organ/space

Superficial incisional SSI
Deep incisional SSI
Organ/space SSI
Environmental Quality Awareness of Internally Generated & Transmitted Microbial Contaminants

EQI is a simulated surgical procedure that follows proper techniques for scrubbing and gowning with each team member movements and placements similar to typical procedures while they are generating and gathering data.

SBAR - FUNDAMENTAL SITUATION: NO REGULAR USER UNDERSTANDS ROOM BY ROOM AIR DISTRIBUTION PATTERNS!
In Vitro & In Vivo Testing
Particle, Microbial, Temp, Velocity, CO2, & RH Monitoring

<table>
<thead>
<tr>
<th>ISO Cleanroom Classification Table</th>
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<tbody>
<tr>
<td>ISO classification</td>
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<tr>
<td></td>
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<tr>
<td>Certified every 6 months</td>
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<tr>
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<tr>
<td>Iso Class 4</td>
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<td>Iso Class 5</td>
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<tr>
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<td>Iso Class 8</td>
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<td>Iso Class 9</td>
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Remote Particle Counter Sensor
Risk Mapping Algorithm for Surveillance System

SBAR - FUNDAMENTAL IMPROVEMENT: INFORM USERS OF ROOM BY ROOM AIR DISTRIBUTION QUALITY RISKS!
Example Orthopedic OR - QI Bundle Re-Design

Aim to Reduce errors during surgical setup

Primary Drivers:
- Reduce transmission of infection and colonization
- Reduce infection once colonized

Secondary Drivers:
- Decolonization
- Screening patients
- Good hygiene
- Bundles

Change Ideas:
- Try chlorhexidine washcloths
- Test standing order for screening
- Feedback hand hygiene adherence rates
- Incorporate adherence check on rounds

HRO: Evidence based process bundles + performed as intended consistently overtime = clinical excellence.
# Twenty Operating Room Optimization Project & Retrospective Study

<table>
<thead>
<tr>
<th>Operating Room</th>
<th>Improvement Date</th>
<th>#SSI/ #Surgeries</th>
<th>Proportion SSI before Improvement</th>
<th>#SSI/ #Surgeries after Improvement</th>
<th>Proportion SSI before Improvement</th>
<th>Proportion SSI after Improvement</th>
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</table>

**p=0.039**

| %SSI | 43/511 | 8.4% | 56/659 | 8.5% | 29/543 | 5.3% |
“OnSite’s environmental quality improvement (EQI) assessment tools and recommendations helped our team to be recently recognized by The Joint Commission as *Leading the Nation* in overall environmental monitoring & performance.”

BS, MPH, CIC, CLCMSN, RN
Director, Infection Prevention
Adult Academic Medical Center


Markel, T., Gormley, T., Greeley, D., Ostojic, J., and Wagner, J. Wearing long sleeves while prepping a patient in the operating room decreases airborne contaminants. AJIC. November 2017b. DOI: https://doi.org/10.1016/j.ajic.2017.10.016


Gormley, T., Greeley, D., Wagner, J.A., Markel, T., Jones, H., and Clarke, J, Ostojic, J.

Thank You!

Questions

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