# Is low indoor humidity a driver for healthcare-associated infections?

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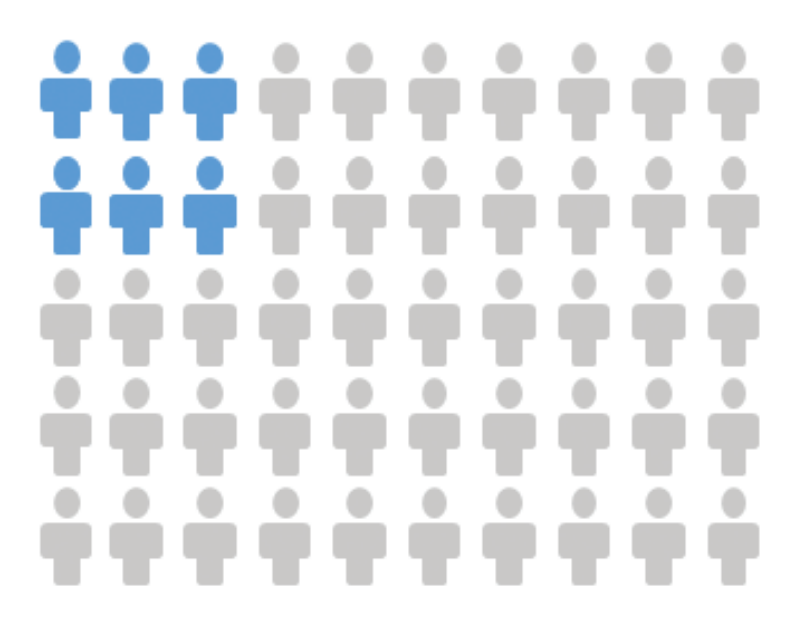
Paper 340, Session 98

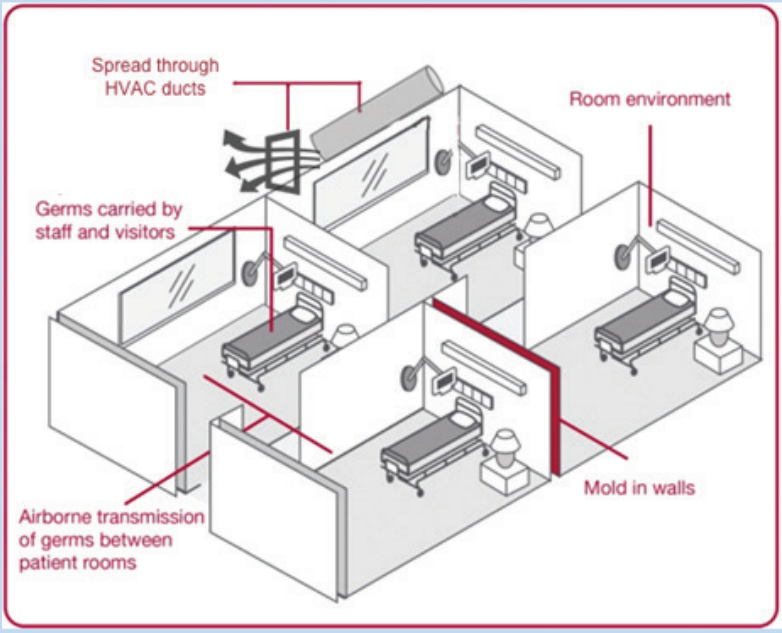
# We go to the hospital to get healthy, but ...

more than 10% of patients



are harmed by new infections (HAIs) ...

## We asked, "How does the built environment, especially indoor air management, influence transmission of infectious germs?"

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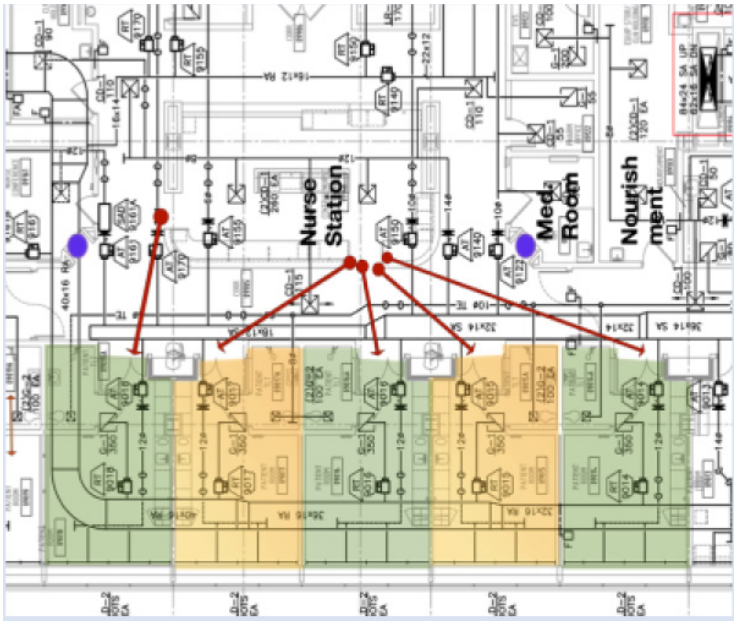
In the US and Europe, errors during in-patient medical care is the 6th leading cause of death (6). A significant portion of this terrible statistic are deaths due to new infections, called nosocomial or healthcare-associated infections (HAIs), that patients acquire while in the hospital. At least 10% of all patients who enter an inpatient healthcare facility for treatment will develop a HAI(2). Tragically, in the US alone, the number of deaths from these infections is over 100,000 annually. What are the environmental factors behind this situation and what more can we do to control the epidemic?

## Our study: Indoor building environment and patient clinical outcomes

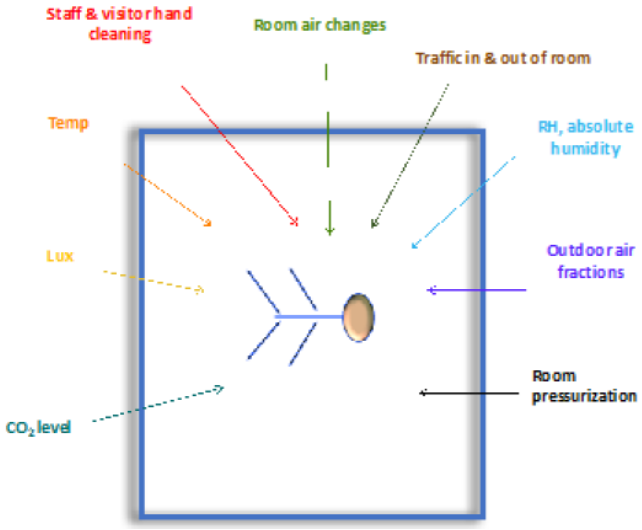
### The Building

Ten patient rooms across two floors were studied for 12 months. Five rooms on one floor were for patients with acute medical or surgical conditions. Patients on the other floor were being treated for cancer and were more likely to have immune system deficiencies.




### Patient Room Monitoring

Environmental parameters were measured every 5 minutes in the ten patient rooms, yielding several million data points over the year-long project.




### Patient HAIs

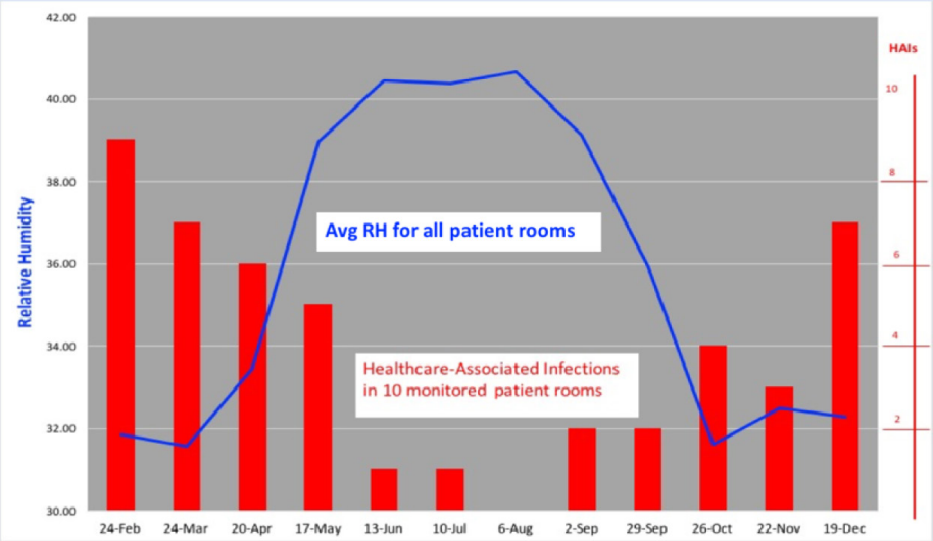
Patient outcomes determined from de-identified records were related to room measurements. Multivariate statistical analysis with linear regression was then run to see if any building parameter was significantly related to new patient infections (HAIs). HAIs as shown here were found.

| | Clinical symptoms | HAI Organisms |
|---|---|---|
| 1 | site of infection not specified | Citrobacter infection |
| 6 | colitis and diarrhea | Clostridium difficile |
| 6 | post-surgical wound infection | organism unspecified |
| 2 | pneumonia | Cytomegalovirus, Pseudomonas, Epstein-Barr virus |
| 5 | urosepsis | organism unspecified, e Coli |
| 3 | infection with joint prosthesis | MRSA |
| 6 | central line with blood stream infection | bacteria unspecified |
| 4 | pneumonia | organism unspecified |
| 1 | gastritis, enteritis | Cytomegalovirus , salmonella, |
| 4 | bacteremia | organism unspecified |
| 2 | pneumonia | MRSA |

Patient HAIs were inversely associated with relative humidity (RH) as an independent variable in the respective patient care rooms.

RESULTS: Relative humidity below 40% is associated with an increased prevalence of patient HAIs.

ACKNOWLEDGEMENT
The microbial sampling and analysis was done by the Hospital Microbiome Project, University of Chicago, Chicago, Illinois USA by Simon Lax, Daniel Smith, Naseer Sangwan, Kim Handley, Peter Larsen, Miles Richardson, Emily Landon, John Alverdy, Jeffrey Siegel, Brent Stephens, Rob Knight and Jack Gilbert with funding from the Alfred P. Sloan Foundation Multi-variant analysis with regression for relative humidity Pvalue < 0.02.




Conclusion: Humidification offers an effective yet underutilized preventive measure against healthcare associated infections caused by both bacterial and viral infections. RH from 40% - 60% may provide patients a safer indoor environment.

REFERENCES:
1. Anderson R.N . 2005. Deaths: leading causes for 2002. National Vital Statistics Reports 53( 17), 67- 70.
2. Classen D.C, Roger R, Griffin F, Federico F, Frankel T, Kimmel N, Whittington J.C, Frankel A, Seger A. James, B. 2011. 'Global Trigger Tool' Shows That Adverse Events In Hospitals May Be Ten Times Greater Than Previously Measured. Health Affairs, 30(4), 581-589.
3. Eames I, Tang J.W, Li Y, Wilson P. 2009. Airborne Transmission of Disease in Hospitals. Soc. Interface, 6, 697-702.
4. Fernstrom A, Goldblatt M, 2013. Aerobiology and its Role in the Transmission of Infectious Diseases, Journal of Pathogens, Volume 2013, Article IS 493960, 13 pages.
5. Ramos T and Stephens B. 2014. Tools to improve built environment data collection for indoor microbial ecology investigations. Building and Environment, DOI : 10.1016/ j.buildenv. 2014. 07.004.
6. James J.T.2013. A New, Evidence-based Estimate of Patient Harm Associated with Hospital Care. Jpatient Safety 9(3), 122-128.
7. Reed 0. and Kemmerly S. 2009. Infection Control and Prevention : A Review of Hospital-Acquired Infections and the Economic Implications. Ochsner J. Spring; 9(1), 27-31.