Invitation to Health Care Real Estate and Facility Leaders to Help Advance Evidence-Based Ventilation Rates and Alternative Standards Compliance Paths

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Executive Summary

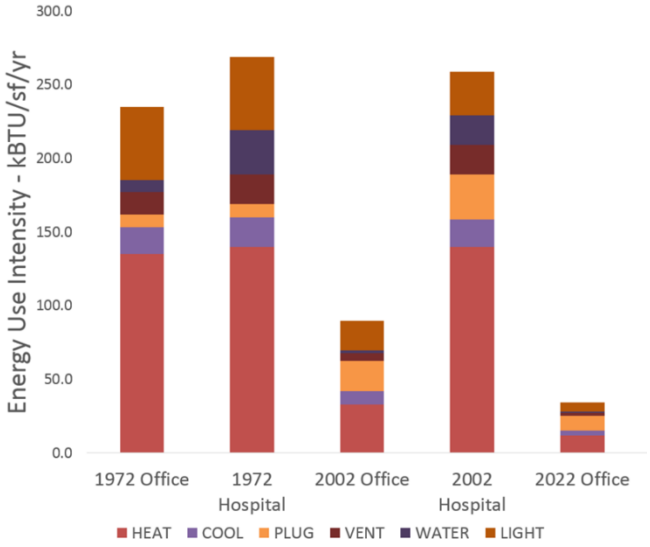
Addressing large scale challenges such as climate change and healthcare reform is daunting; addressing them simultaneously is a unique opportunity. Healthcare is tasked simultaneously with:

- transitioning from volume-based care to value-based care,
- improving the built environment of care,
- decreasing our green house gas emissions,
- increasing our facilities' resilience to extreme events and emergencies, and
- addressing climate change's impact on individuals and communities, THE defining public health threat of the century.

In this context, it becomes far more important to control the 1-3% of budget hospitals typically spend on energy.

A growing community of owners have come to realize they are wasting a lot of energy and money because most hospitals over-ventilate most of their space most of the time. Over-ventilation is largely the result of the need for regular tuning of equipment, and especially national hospital ventilation standards that have not fully kept pace with progress in other sectors. They also fail to reflect the fact only 10-15% of health care floor space needs to be treated as specialty environment, requiring different ventilation rates and controls for the purpose of infection prevention.

The technical feasibility of meeting the challenge of reducing over-ventilation in healthcare is already proven in the commercial sector, where best practices and a 40 year body of scientific and engineering literature demonstrate indoor air quality can be maintained with much lower energy use intensity (EUI). By comparison, hospitals have seen relatively little change in EUI over time.



Operational and Clinical Costs

Ventilation requirements for hospitals are published as ASHRAE/ASHE Standard 170 in an easy to use and prescriptive table indicating ACH requirements by space type. However, prescriptive minimum ACH rates drive a tremendous amount of unnecessary fan, cooling, and heating energy. Adopting more adaptive ventilation standards reform could

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potentially save $2 - $3.5 billion annually in hospital energy costs nationally, 20%-30% of the electricity and 30%-50% of the natural gas used, reducing health care sector carbon emissions by 8.5 to 14 million metric tons of CO2 equivalent (MTCO2e), while maintaining infection prevention, patient and staff comfort, and improving facility and community air quality**.**

Asthma is widely acknowledged to be a significant driver of health care costs and avoidable admissions (and re-admissions), worthy of special attention. Similarly, allergy related illnesses are increasing as temperatures rise impacting air quality, as are cardiovascular concerns. Depending on circumstance, reducing emissions from hospital energy use can be proximal to these. In general, as the links between energy, pollution and human health intensify, and payment models focus increasingly on population health, the fiscal case for energy efficiency has never been more compelling or aligned to core mission.

The long term benefits of any healthcare code changes while maintaining and enhancing patient health/staff well-being would primarily take the forms of:

1. financial savings – in both construction costs due to greater design flexibility, and operating costs due to energy savings from more precisely targeted, and mostly lower rates of ventilation.
2. reduced environmental health impacts, green house gas emissions and improved air quality leading to community health improvement
3. increased facility resilience by eliminating unnecessary demand for natural resources, which also lowers demand peaks, increases flexibility in demand response, and improves the viability of gensets, energy storage, CHP, fuel cells and/or renewable energy options.

Moving From Problem Definition to Action

Thus, there is growing interest in updating and/or 'reforming' hospital ventilation standards. ASHRAE Standard 62.1 - "Ventilation for Acceptable Indoor Air Quality" provides a model code for commercial buildings in the U.S., with the exception of hospitals, which utilizes ASHRAE/ASHE Standard 170 – "Ventilation of Health Care Facilities." Whereas the former allows design engineers to achieve proper ventilation via three, more flexible calculation methodologies, the latter relies on a single prescriptive methodology, dictating minimum air changes per hour (ACH) rates by space type. See also Appendix A, " Addressing an Important Myth: A Brief History of Ventilation Standards in US Hospitals"

A Solution Path

The process of code change is not defined per se, nor linear, and updates to ASHRAE/ASHE Standard 170 are no exception. Admirably, ASHRAE/ASHE Standard 170 voting members and meeting attendees are primarily focused on patient outcome, and the spirit of the Hippocratic Oath and “First do no harm” resonates deeply.

Related, but not directly connected, is the ASHRAE Technical Committee 9.6, Healthcare Facilities which includes a Research sub-committee. But even research sanctioned by this group, as well as other research, has no clearly prescribed path to influence the code in the ASHRAE/ASHE Standard 170 discussions or process.

In 2014, Kaiser Permanente began questioning the alignment between ASHRAE Standards 55, 62.1, and 170. ASHRAE responded by commissioning a research project to study the background of all requirements in the relevant standards and codes. The project has been underway for over a year.

In response to the need to reduce waste and cost, protect health, and to move toward evidence-based ventilation rates, updates to Standards and/or alternative compliance methodologies, health care organizations nationwide are being asked to participate in any combination of the following five actions:

1. Educate internal stakeholders to raise awareness and address concerns, define the potential benefits to your particular facility(ies), health system or even region(s)
2. Attend and/or contribute to educational and strategy webinars and conference calls
3. Support and Advocacy: Sign petitions of support and/or engage in coordinated letter writing to standards organizations
4. Participate in data collection via survey(s)

5. Participate in data collection via pilot project(s)

1. Slide decks, background documents and conference calls are available to help bring others along, and 'build the case.' www.noharm.org/improvingventilation

2. Active stakeholders stay informed via email, free webinars and a conference call every other month. Upcoming: Wednesdays at 1:30 PM ET: Dec. 14, Feb. 8, 2017, April 12, 2017

3. Support and Advocacy
By reaching out to the A&E community, national organizations such as ASHE and it's local chapters etc., interested stakeholders can grow the community of interest and demonstrate solidarity, and encourage ASHRAE to take constructive action in a prompt and timely manner.

4. Participation in Surveys
In order to improve how the healthcare built environment will perform in the future, data is needed to understand how it is performing now. Surveys will be used to gather stakeholder input on key issues and to understand current practices in operating and maintaining HVAC systems and controls, commissioning, etc.

5. Participation in Pilot Projects(s)
Pilot projects will undertake some form of ventilation innovation, deviating from the existing code (air change per hour, or ACH) framework, in well defined non-protective space(s) in one or more facilities. [For details, see *"Sample Protocol for Ventilation Pilots to Advance Energy Saving Opportunities*" www.noharm.org/improvingventilation.

Ideally over an 18 month period, pilot sites will reduce HVAC minimum ventilation rates and report outcomes including energy performance, indoor air quality (IAQ), relevant infection prevention outcomes, patient and staff comfort. These will be shared with interested parties (anonymized, if requested), to help provide a basis for updated standards and/or alternative compliance methodologies.

Staffing and Support
At Kaiser Permanente's and other health care providers' request, Health Care Without Harm (HCWH) has agreed to act as a convener/coordinator of an ongoing sector dialogue and collaboration, with support from Paul Lipke, HCWH's Senior Advisor for Energy and Buildings, and Eric Lerner, HCWH Climate Director and staff for HCWH's Health Care Climate Council. Advisory technical support will be provided by Kaiser Permanente's Travis English, Chief Design Engineer/Director of Engineering and Maya Salabasheva, Kaiser Permanente's Principal Mechanical Engineer, amongst others.

For more documents and background:

- KP's document archive: https://sites.google.com/site/travisenglish/
- HCWH's web page on Ventilation Standards: www.noharm.org/improvingventilation

For questions or to get on the circulation list, contact Paul Lipke, Senior Advisor Energy and Building, Health Care Without Harm, 413-367-2878

#END, Appendixes Follow#

APPENDIX A:

Addressing an Important Myth: A Brief History of Ventilation Standards in US Hospitals

The connection between patient outcomes and proper ventilation dates back to the 1870s, famously pointed out by Florence Nightingale. Patients were held in wards, often unventilated, lit by candles or oil burning lamps, and with no bathrooms. The patients used bedpans which sat until the nurses had time to empty them. Horrible odor and hygiene resulted, and beginning in the 1870s-1880s, architects began designing wards based on volumetric air principles. They used 100 square feet per bed, 1000-1500 cubic feet per bed, and enough window area to exchange the volume of air "twice per hour" [16]. To this day, 2 "air changes per hour" (ACH) of outdoor air remains a ventilation standard for hospitals.

The current 6 ACH of total air requirement dates back to the 1960's architectural design guidelines for health care facilities. US Hospital guidelines were published by the Public Health Service from 1947-1984, then by the American Institute of Architects, from 1987-1994, then by the Facilities Guidelines Institute, from 1998 to today. Contemporary use of 6 ACH as a general prescription is frequently attributed to a thermal comfort simulation study [17], which indicated 6 ACH as a good overall number for thermal comfort and uniformity in patient rooms. The study itself does not present 6 ACH as an exclusive solution. ASHRAE Standard 170 recently reduced the requirement to 4 ACH in patient rooms, citing the same study. The broader body of thermal comfort literature does not support 6 ACH as a one-size-fits-all requirement for comfort in every patient room in every climate. 6 ACH has only ever been associated with thermal comfort in patient areas. No other commercial building type carries such a requirement.

Further research has defined those early ventilation principals as Indoor Air Quality (IAQ), the *"air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants"* [1]. Air quality standards, stated as acceptable limits of contaminants, are developed by multiple sources including the ACGIH [2], OSHA [3], NIOSH [4], and EPA [5]. But the prescriptive air change rates of ASHRAE/ASHE Standard 170 remain.

HVAC trade literature has long and often asserted that while 90% of Hospital Acquired Infections (HAI) are gained by direct contact, 10% could be the result of airborne transmission [6]. Multiple recent meta-research studies ([7] [8] [9] [10] [11] [12]) have not validated ventilation practices or established minimum ventilation rates on this basis, for all but a few select spaces and cases. The areas where ventilation is known to be relevant to patient outcomes are Operating Rooms (ORs) [13], Airborne Isolation Rooms (AII) [14], and Protective Environments (PE) [15] for severely immune-compromised patients.

<u>Hospital Ventilation Standards in Other Countries</u>

Much of Europe relies heavily on natural ventilation (outside air openings or operable windows) for patient spaces. The German standard (DIN-1946) of minimum outdoor air per person appears to be the standard used in Switzerland, Holland, Japan and other parts of Europe (ventilation rates are equivalent to 15-25 cfm per person [18], very similar to ASHRAE 62.1). Spain and the UK encourage ample ventilation with outdoor air [19] [20].

The World Health Organization (WHO) includes IAQ as an element of its Practical Guidelines for Infection Control. WHO guidelines also emphasize natural ventilation, with rates calculated based on the number of patients [10].

Appendix B: CITED REFERENCES

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