Meeting The Need For Lifetime Housing

In the face of an aging demographic mechanical professionals can choose to observe, follow or lead change. **BY ROBERT BEAN**

The expression, "long term care" rarely invokes thoughts of a non-institutional healthcare facility, such as one's own home, but toss in phrases such as, "Aging in Place" or "Universal Design" and most people in the world of building and health science know what you are referring to. I have always seen these descriptors as lacking in substance because the implied ergonomics of such spaces is predominately product- or geometrically-based (i.e., devices or aids for daily living and accessibility). They virtually ignore the indoor environmental ergonomics of light, sound, thermal comfort and indoor air quality (IAQ).

I am not aware, for example, of any residential builder along with their HVAC contractor who designs homes to accommodate the scope of CSA Z317.2 Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Health Care Facilities or ANSI/ASHRAE/ASHE Standard 170 Ventilation of Health Care Facilities. Yet some elements from these institutional standards, and all of the elements of ANSI/ASHRAE Standard 55 Thermal Environmental Conditions for Human Occupancy, have a place in homes that for some, will become non-institutional, end of life satellite facilities to the institutional healthcare system. For this reason I am more supportive of the terms "inclusive housing" or "lifetime housing." These recognize that indoor environmental systems are in fact on an evolving continuum serving the physiological needs of the newlywed through to the nearly dead, in the same way ergonomics addresses products and space geometries to accommodate changes in physical abilities.

Consider the physical and physiological changes due to aging on: mobility, agility and personal and environmental hygiene. Consider that respiration, thermal, sound and lighting discomfort drive behaviour. For the able bodied, the active and adaptive strategies of opening a window, putting

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on a sweater, adjusting a thermostat or closing the blinds is easily accomplished. In the case of seniors or those with disabilities, these seemingly simple tasks can be hampered by reduced agility and mobility, reduced visual acuity, loss of manual dexterity and impaired cognitive abilities.

Compensating for general and local discomforts such as drafts, cold floors, excessive temperature stratifications and radiant asymmetry can become very difficult. This is compounded for those with circulatory ailments or diseases affecting thermal regulation. Also, consider the effects to the respiratory and olfactory systems from the use and inadequate disposal of incontinence products, or failures to respond to building-related moisture problems resulting in environments supportive of mould, bacteria and other microbes.

Those who live indoors with pets and/or smokers, and subsequently become "immune" or "desensitized" to the odours, illustrate an unfortunate aspect of the olfactory system and hygiene. They are not immune to the physiological effects of microbial associated with animal urine and feces, or toxins from tobacco products. Add in the fact that air-based heating and cooling systems require recirculation of contaminated air, regardless of the means of ventilation.

What develops is a complex combination of indoor environmental quality aspects that are very difficult for live-in or visiting caregivers and can create both physiological and psychological stress for all involved. This is particularly true in the presence of better living options, such as modern institutional healthcare facilities.

The worse case scenario is the senior with physical and mental disabilities and impaired hygiene who refuses to leave his/her dilapidated home regardless of the conditions. At the other end are the able bodied, active seniors who have no problem taking care of themselves and their property and are quite satisfied with their indoor environments.

To give some perspective around the demographics, this quote relating to the Alberta population states: "Most seniors live in private housing. In 2006, approximately 71 per cent of the seniors' population lived in homes that they owned. An estimated 19 per cent resided in rental accommodation and about seven per cent lived in provincial housing settings, including seniors' lodges. Approximately three per cent of seniors lived in long-term care facilities.i Regardless of the quantitative distribution of quality of living standards, the message is that most seniors avoid the institutional offering but the need for the environmental offering of the modern institution is present regardless.

In addition to the need for healthcare standards in conditioning of air, lighting, sound and thermal comfort systems, there may be need for specialized healthcare devices and instruments for those who stay home right to the end. Many of these aids, such as dialysis and oxygen machines, lifts and elevators, need an uninterrupted power supply of sufficient load capacity.

Some equipment is sensitive to electromagnetic interference or to indoor environmental conditions such as temperature and humidity and other devices are sensitive to light. ii Devices needing air filtration are sensitive to particles, such as pet hair, lint and dust.iii Many of these devices are wheel mounted, as such the choice in floor coverings is also an important consideration. Lifetime housing requires the original designers to think about future power needs, HVAC systems, interior design, as well as the more traditional "Aging in Place" or "Universal Design" principles.

As noted by specialists in the field, "The goals of human factors are to optimize human and system efficiency and effectiveness, safety, health, comfort, and quality of life. iii In consideration of these factors and the home as an "end of life satellite facility" to the institutional healthcare system, I default to the virtually invisible and integrated HVAC strategies of;

1. Radiant cooled and heated slab on grade floors for safety, hygiene, comfort and efficiency.
2. Dedicated outdoor air systems with high performance air filtration on the intake for indoor air quality, efficiency and effectiveness.
3. Heat recovery on the exhaust for efficiency.
4. Dedicated dehumidification and steam humidification for indoor air quality and comfort.
5. Backup power supply of sufficient capacity for life safety systems,
6. Extra circuit outlets in one or more "care" rooms to accommodate future equipment.

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For many it will be difficult if not impossible to predict end of life states of physical, physiological and psychological heath. Likewise, it will be difficult, if not impossible, to predict the required and necessary state of the power systems, interior design and indoor environmental systems necessary to serve the occupants in an end of life non-institutional facility. However, with certainty one can observe, follow or lead the changes necessary to integrate "lifetime housing" principles today to serve one or more generations over the evolving continuum of indoor environmental quality. <>

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REFERENCES

i) Seniors' Programs ENetwork, (Alberta), No. 84, September 2, 2011

ii) The Role of Human Factors in Home Health Care: Workshop Summary, National Research Council, National Academy of Sciences, 2010

iii) Health Care Comes Home: The Human Factors, Committee on the Role of Human Factors in Home Health Care, Board on Human-Systems Integration, Division of Behavioral and Social Sciences and Education, National Academy of Sciences, 2011

BIBLIOGRAPHY:

1. The Center for Inclusive Design and Environmental Access. http://www.ap.buffalo.edu/idea/
2. National Academy of Sciences - Health Care Comes Home: The Human Factors. http://www.nap.edu/catalog.php?record_id=13149
3. The Canadian Building and Health Sciences Network (CBHSN) http://cbhsn-rcesbs.proteus.cisti.nrc.ca/eng/relevant.html.
4. Chan, S.L., Wei, Z., Chigurupathi, S., Tu, W., Compromised respiratory adaptation and thermoregulation in aging and age-related disease, Ageing research reviews, 2009. http://www.ncbi.nlm.nih.gov/pubmed/19800420
5. Taylor, N. A.S.., Machado-Moreira, C., van den Heuvel, A., Caldwell, J., Taylor, E. A.. & Tipton, M. J. The roles of hands and feet in temperature regulation in hot and cold environments. Thirteenth International Conference on Environmental Ergonomics; Boston, USA: University of Wollongong; 2009. 405-409. http://ro.uow.edu.au/hbspapers/190/