IN A WORLD THAT IS WARMING AND GRAYING . . . .

Rethinking how to design and build our homes and communities

SHERRY AHRENTZEN, PHD / SHIMBERG CENTER, UNIVERSITY OF FLORIDA
University of Miami, Department of Public Health Sciences, Distinguished Speakers Series
COLLISION OF 3 STORMS

CLIMATE CHANGE
Recent IPCC and US National Climate Assessment reports

DEMOGRAPHIC TRANSFORMATIONS
By 2034, # of Americans 65+ > # younger than 18

HEALTHCARE NEEDS + COSTS
Hospitals/clinics ↔ homes
OVERWHELMING PUBLIC HEALTH FOCUS TO DATE: HEAT WAVES + MORTALITY
Stakes keep rising

Scientists are projecting scores of additional deaths in U.S. cities due to extreme heat if global temperatures rise above 2 degrees Celsius.

Average deaths per 1-in-30-year heat event

- Present day
- 1.5 degrees of warming
- 3 degrees of warming

Cities: Atlanta, Boston, Chicago, Dallas, Detroit, Houston, Los Angeles, Miami, New York, Philadelphia, Phoenix, San Francisco, Seattle, St. Louis, Washington, DC

Deaths per 100,000 people

Sources: Eunice Lo, Kristie L. Ebi, Peter Frumhoff
Chart: Nigel Chowney / NBC News
WIDENING OUR VISION OF HEAT STRESSORS + IMPACTS

Chronic indoor thermohygrometric conditions may or may not be “heatwave” related

Health impacts beyond mortality respiratory, pulmonary, heart attacks, heat stroke, CVS, blood pressure, dehydration, sleep, agitation, etc.

Built environment/infrastructure contributors + mitigation

Social, economic and physiological conditions
WHY AGING?

PHYSIOLOGICAL FACTORS SUSCEPTIBLE TO HEAT

• Reduction in body’s ability to thermoregulate; and perception of external temperature experience (neurosensory changes)

• Lower metabolic rate; lower cardiovascular flexibility, reactivity, output

LIVING PATTERNS

• Sedentary. 90-100% time spent indoors, at home

• Higher usage of pharmaceuticals, e.g. for blood pressure, cholesterol

• Live alone, social isolation, depression

• Desire to “age in place” or “age in community”

• Less mobile, unable to reach cooler locations in heat wave

• Many live in older homes

SOCIETAL

• Building standards do not take into account thermal comfort or sensation of older adults
VULNERABILITY

Inherent to the system, not individual

Created or exploited by the hazard or environment
PSYCHOTROPIC DRUG USE

HIGH INDOOR TEMPS

AGITATION

DEMENTIA

HOME+ HEALTHCARE STAFF DEMANDS/ RESPONSE

CASCADING + CYCLICAL EFFECTS

CYCLE OF DEMENTIA AND THERMAL RESPONSES

• Altered sensitivity to environmental conditions
• Increasingly reactive to their environment
• Behavioral problems (e.g. agitation) affect care staff and other residents
WHO HOUSING AND HEALTH GUIDELINES

RESEARCH REVIEWS + HOUSING REGULATORY GUIDELINES

INDOOR TEMPERATURES + MORBIDITY EVIDENCE

- 8 studies, range of methodologies, samples, countries: mixed findings
- Sleep, emotional distress, viral infection, CVS, blood pressure, respiratory distress, stillbirth, miscarriage, quality of life/health
- Few studies actually measure indoor temps, but that is changing
IS GREEN HOUSING HEALTHY HOUSING FOR OLDER ADULTS?
KEY RENOVATIONS

Insulation and improvement in **building roof**

**PTAC system upgrades**

**Energy Star** exhaust fans, appliances

New bedroom **ceiling fan** with pull-cords

**Double-pane, low-E sliding** balcony door and window

Low-flow **plumbing fixtures**

Complete **kitchen** and **bathroom remodel** with low-VOC materials

Low-VOC **flooring, paint, adhesives**

$1.7M renovation from ARRA Green Retrofit Program

3-story, 116-unit, each unit 619 SF
FINDING:

POST INTERVENTION, REDUCTION IN VARIABILITY OF HOMES WITH EXTREME TEMPERATURE EPISODES (PEAKS)

Count = # of times of 448 data points that indoor temperature exceeded 81°
FINDING:
REDUCTION IN # OF TEMPERATURE “PEAKS” RELATED TO SELF-REPORT HEALTH OUTCOMES OF...

QUALITY OF LIFE/HEALTH
SLEEP
EMOTIONAL DISTRESS

Reductions in indoor temperatures over 81°F resulted in:

- *improved* quality of health/life
- *increased* hours of sleep
- *reduced* emotional distress

![Diagram showing findings with t-values and p-values for improved quality of health/life, increased hours of sleep, and reduced emotional distress.]

<table>
<thead>
<tr>
<th></th>
<th>Panel 1</th>
<th>Panel 3</th>
<th>Fixed-Effects Regression</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>t-value</td>
</tr>
<tr>
<td>Improved</td>
<td>3.170</td>
<td></td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Increased</td>
<td>2.150</td>
<td></td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Reduced</td>
<td>2.085</td>
<td></td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

*Green Renovation*
IS OUR HOUSING STOCK READY FOR AN AGING POPULATION DURING ERA OF GLOBAL WARMING?
Demand for Air-Conditioning

- # of a/c units worldwide rise from 1.6B to 5.6B by 2050
- Instrumental in cutting premature deaths on hot days by 75% since 1960
- Emissions and venting hot air outside home
- Routine maintenance needed
- Cost
Facing unbearable heat, Qatar has begun to air-condition the outdoors
Power Outages

- Post-Irma response in Florida: Back-up generators in ALFs, SNFs
- Approximately 5% of 65+ live in nursing homes, assisted living, board/care, etc.
Passive & Non-Mechanical Features

- Air flow
- Materials and insulation
- Solar orientation of homes, developments
- Shading
- Cool paving, low albedo
- Others
Urban Heat Island

- High albedo
- Mitigate: trees, vegetation, shading devices, green roofs, cool roofs, others
- Modeling, assessments
University of Georgia analysis of 50 most populous metro areas in US, using PRISM climate data: https://www.sciencedirect.com/science/article/pii/S0198971515300089
The walkway through Umbrella Park in Doha, built to connect the Lotusium promenade and the post office, helps keep pedestrians out of the hot sun.

The walkway uses umbrellas and plants to create a more tolerable atmosphere for pedestrians.
#5

**Social Connectivity**

- In U.S., living alone major risk factor during heatwaves for older adults
- Emergency preparedness programs
- Co-living models, e.g. Village Network
- Senior advocacy groups on climate change
QUESTIONS + DISCUSSION

Thank You

SHERRY AHRENTZEN, PhD

Shimberg Professor of Housing Studies,
University of Florida

ahrentzen@ufl.edu