THATIS 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



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



Chart: Nigel Chiwaya / 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

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°

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FINDING: REDUCTION IN # OF TEMPERATURE "PEAKS" *RELATED TO* SELF-REPORT HEALTH OUTCOMES OF...

QUALITY OF LIFE/HEALTH

SLEEP

EMOTIONAL DISTRESS

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IS OUR HOUSING STOCK READY FOR AN AGING POPULATION URING ERA OF WARMNG?





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

2°C: BEYOND THE LIMIT

Facing unbearable heat, Qatar has begun to air-condition the outdoors

Washington Post, Oct 16, 2019





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.
- Entering an era of unexpected and scheduled black-outs and brown-outs. Aging electrical infrastructure.





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









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



SHERRY AHRENTZEN, PhD

Shimberg Professor of Housing Studies, University of Florida

ahrentzen@ufl.edu