SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

To use Distributed lag models (DLMs) to predict the future internal temperatures of different spaces within different hospital spaces.

DESIGN IMPLICATIONS

In order to provide healthcare environments that are heat resistant and capable of meeting carbon emission goals, designers could consider adopting various aspects of the Nightingale Ward and Masonry Ward designs mentioned in this study. The benefits of these designs highlight the importance of spatial orientation relative to the sun as well as the use and prevalence of specific building materials, such as brick walls and glazed windows.

The influence of hospital ward design on resilience to heat waves: An exploration using distributed lag models

Iddon, C. R., Mills, T. C., Giridharan, R., & Lomas, K. J. 2015 | *Energy and Buildings*. Volume 86, Pages 573-588

Key Concepts/Context

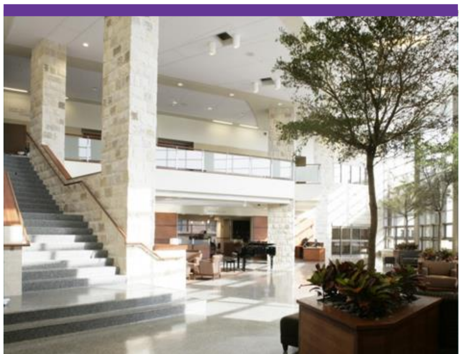
Prolonged periods of uncharacteristically high outdoor temperatures (often referred to as "heat waves") are correlated with increases in localized mortality rates. Hospitals have a responsibility to protect patient populations from harmful weather conditions, especially chronically ill patients that are vulnerable during prolonged exposure to high temperatures. Air conditioning systems and designated "cool zones" are some of the previously proposed solutions to heat wave complications within healthcare environments; however, widespread use of air - conditioning is unlikely to help with any carbon emission reduction goals. It is therefore important to be able to predict future internal temperatures of different spaces within healthcare environments so that optimal treatment can be effectively provided. This can be accomplished with distributed lag models (DLMs).

Methods

Internal temperatures and hourly weather data were recorded from 11 spaces within two different UK National Health Service (NHS) hospitals. DLMs were created using data gathered during the summer of 2011 and were subsequently validated against data from the summer of 2012. These DLMs were then used to predict the performance of wards in different building types (Nightingale Wards, Modular Wards, 'Matchbox on a Muffin' type Wards, and Masonry Wards) during extremely hot conditions modeled after a 2006 European heat wave.

Findings

Both the Nightingale Wards and Masonry Wards proved resilient in hot weather performance, while modular buildings were projected to overheat to dangerous extents. Overall building orientation, internal and external materials, and patterns of occupancy largely influenced these results. DLMs proved to be an effective way



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to predict internal temperatures and the ability of certain spaces to remain cool during heat waves.

Limitations

The authors note that DLMs are only capable of making predictions based off past internal temperatures and changes to exogenous drivers. This study focused on building designs that may be unique to a certain region and uncommon in other parts of the world. Data used to help formulate the DLMs were sourced from a span of one year.

The Knowledge Repository is provided with the funding support of:

AIA Academy of Architecture for Health of the American Institute of Architects

ASHE American Society for Healthcare Engineering A personal membership group of the American Hospital Association

AAHF Academy of Architecture for Health Foundation

FGI

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NIHD Nursing Institute for Healthcare Design LEADERSHIP • EDUCATION • ADVOCACY

RESEARCH DESIGN connections