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Associations of occupant demographics, thermal history and obesity variables with their thermal comfort in air-conditioned and mixed-mode ventilation office buildings

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Abstract

Building occupants' perception of thermal comfort can be influenced by a number of contextual factors, such as their demographic and anthropometric characteristics, behavioural patterns and cultural aspects. The objective of this work is to investigate the relationship between various contextual factors and the perception of thermal comfort in workplaces, by examining the gap between the current thermal comfort criteria and the actual requirements observed for different groups of occupants. The classic thermal comfort field research design i.e. simultaneous measurements of physical environmental parameters and questionnaire surveys, was implemented for two years in both centralised HVAC and mixed-mode office buildings located in Southern Brazil. Over 7,500 questionnaires were completed by occupants of the buildings. Key variables including the participants' gender, age, body mass index, prior exposure to air-conditioning and building ventilation type were investigated in order to identify their association with thermal discomfort in the office workplace. Our results suggest that males, overweight occupants and those who are more frequently exposed to air-conditioning are more likely to express thermal discomfort due to feeling 'warm', compared to females, non-overweight occupants and those who were exposed to air-conditioning less frequently. In comparison, females, non-overweight occupants, air-conditioning light users, and occupants of centralised HVAC buildings were more likely to declare 'cold' discomfort. We also investigated how those variables were related to the width of thermal comfort zone. The analysis indicates that different groups of occupants require different comfort zones, suggesting that group differences should be considered when designing/operating spaces for diverse groups of occupants.

Keywords: human thermal comfort; gender; obesity; thermal history; mixed-mode buildings.

1 Introduction

Since the work of Fanger in 1970 [1], the six most influential variables on human body heat balance were known by means of climate chamber studies: i.e. metabolism and clothing (the human factors), air temperature, mean radiant temperature, air velocity and relative humidity (the environmental factors). However, thermal comfort may not be fully understood just by these six variables in real world situations [2]. Numerous contextual factors can also influence occupants' thermal

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