

Thermal comfort and HVAC design for people with dementia

J. van Hoof^{1,*}, H.S.M. Kort¹, J.L.M. Hensen², M.S.H. Duijnstee¹ and P.G.S. Rutten²

¹Hogeschool Utrecht, Faculty of Health Care, Research Centre for Innovation in Health Care, Bolognalaan 101, 3584 CJ Utrecht, the Netherlands

²Eindhoven University of Technology, Department of Architecture, Building and Planning, Den Dolech 2, 5612 AZ Eindhoven, the Netherlands

*Corresponding email: joost.vanhoof@hu.nl

Tel. +31 30 2585268, Fax. +31 30 2540608

SUMMARY

Thermal comfort is one of the parameters important in building design for which extensive modelling and standardisation exist. These are not always applicable to people with cognitive disorders. People with dementia have an altered sensitivity for indoor environmental conditions, which can induce problematic behaviour that may form a serious burden for professional and family carers day and night. The creation of supportive and comfortable home environments for both people with dementia and partners is a non-pharmacological strategy to increase well-being and to combat the negative effects of temperature 'extremes'. This paper, based on literature review, provides an overview of needs regarding thermal comfort and the design and implementation of heating, ventilation and air-conditioning (HVAC) systems for people with dementia. In principle, older adults do not perceive thermal comfort differently from younger college-age adults. Due to the pathology of people with dementia, as well as their altered thermoregulation, the perception of the thermal environment might be different from that of their counterparts without dementia. Fortunately, a lot can be done to create a comfortable environment. When implementing systems one should however consider aspects like user-technology-interaction, diverging needs and preferences within group settings, safety-issues as electrocution, falls, and wandering, and minimizing negative behavioural reactions as fear and draught due to suboptimal positioning of outlets. At the same time, technology puts demands on installers that need to learn how to work with customers with dementia. Furthermore, they should realise that the performance of buildings is associated with the perception of the user.

KEYWORDS

Dementia, older adults, senses, indoor environment, care, HVAC design, thermal comfort

INTRODUCTION

According to Alzheimer Europe (2006), there are an estimated 6 million people with dementia in the EU. The vast majority of them lives at home, where they are largely dependent on care given by others (van Hoof et al., 2009). People with dementia are known to have an altered sensitivity to environmental conditions, and some may become increasingly reactive to their environment rather than acting upon it (Weaverdyck, 1991). This in turn can result in behavioural problems. The abovementioned changes in

sensitivity imply that dementia has severe implications on daily life, and sets extra demands to living environments, including the thermal environment or indoor climate (van Hoof & Kort, 2009). The home's indoor climate is not only the key factor in providing comfort to the occupants (i.e., community-dwelling people with dementia), but might even be a nonpharmacologic factor in managing problem behaviour accompanying dementia syndrome, and thus a yet largely unexplored and ill-known factor in care support and the reduction of the burden of care.

This paper, based on literature review and qualitative research, studies the needs regarding thermal comfort and the 'comfort-related' design and implementation of relevant building systems for community-dwelling people with dementia in an integral way by focussing on the creation of building values for the relevant stakeholders: the person with dementia, partners, family and professional carers, and professionals from the fields of technology, construction and housing.

THERMAL COMFORT, AGEING, AND DEMENTIA

Thermal comfort is described as 'the state of mind, which expresses satisfaction with the thermal environment'. In principle, older adults do not perceive thermal comfort differently from younger college-age adults. On average, older adults have a lower activity level, and thus metabolic rate, than younger persons, which is the main reason that they require higher ambient temperatures. The ability to regulate body temperature tends to decrease with age (Havenith, 2001). There is also an alternative thermophysiological definition of thermal comfort, which is based on the firing of the thermal receptors in the skin and in the hypothalamus. Comfort in this sense is defined as the minimum rate of nervous signals from these receptors (Mayer, 1993). The traditional concept of thermal comfort is vague for people with an unknown 'state of mind' and without the ability to express themselves reliably. Due to the pathology of many dementia patients, involving atrophy of brain tissue, the perception of the thermal environment, as well as the thermoregulation may be different from older adults without dementia. Much of this is suggested by anecdotal evidence. In a descriptive paper on the housing situation of his demented father, Steinfeld (2002, pp 3) states that over time, his father's "*ability to sense thermal comfort seemed to deteriorate. There were many days when I would arrive to find the heat well near [32 °C] or more. And, in the summer, the opposite occurred with the air-conditioning.*" Expressing satisfaction with the thermal environment, or dissatisfaction in particular, could be expressing certain behavioural symptoms.

THERMAL COMFORT AND SYSTEMS IN PRACTICE

The positive aspects of good thermal comfort are often mentioned in literature. Bathrooms should be comfortably warm, since people undress in these rooms (Brawley, 2002; Petersen, 2002). According to Warner (2000), a person with dementia may not realise that a bathroom is too cold, only that (s)he is uncomfortable, and may not associate the room's temperature with the experienced discomfort or have the ability to communicate it. This often results in frustration, anger or attempting to get away from the discomfort. The diminished understanding of the surroundings also puts demands on the way systems are installed. Electronic (heating) equipment should be kept out of the bathroom as much as possible (Petersen, 2002), although heat lamps installed in the ceiling are an alternative solution (Brawley, 1997; Warner, 2000; Bakker, 2003). Hot

radiators (and water pipes) should be blocked or covered, since people may have difficulty judging the temperature of the device, and pose hazards in case of fall incidents and burn marks (Mace & Rabins, 2006, Lach et al., 1995; Duijnste, 1992). A solution is to install radiant floor heating instead (Brawley, 1997), which also help occupants to keep 'cold feet' warm. Bathrooms, however, may have one radiator panel to warm up towels. Bedrooms should be thermally comfortable too (Petersen, 2002). Nocturnal unrest may be caused by people being too cold or too warm, and can contribute to people going out of bed, which brings along the risk of fall incidents (Blom et al., 2000). In hot summers, silent air-conditioning systems can help people fall asleep, which is both important to people with dementia, and their partners. The position of the outlets of air-conditioning systems or mechanical ventilation, as well as ceiling fans, deserves extra attention. Outlets directing air on curtains or papers on tables can cause them to move. Warner (2000) states that such movement might give the impression to people with dementia that someone else is in the room, even ghosts and thieves.

Warner (2000) and Petersen (2002) describe another consequence of thermal discomfort. People may start to undress as a solution to perceived warm discomfort. Undressing can be embarrassing to all involved. Some may even consider the 'exhibitionist' behaviour as sexual disinhibition, whereas the cause lies in thermal dissatisfaction. In case of cold discomfort, one may put on inappropriate clothing. Warner explicitly states that the carer's views of a comfortable room temperature may not be the same as those of a person with dementia. Thermostats are used for the control of indoor temperatures, but may pose problems to people with dementia. Steinfeld (2002) states that the system's delay in providing hot or cold air is one of the problems, since people forget that they manipulated the system's interface and then think the system is malfunctioning or broken. In his example, the person with dementia overcompensated, and would leave the room with the temperature set all the way up, resulting in extreme indoor temperatures. Those required the temperature to be set the other way, and caused frustration. Covers can be placed over the controls (Brawley, 1997), or thermostats can be pre-set and be disguised (Lach et al., 1995), or simply placed out of sight. Steinfeld (2002) concludes that passive systems require far less intervention on the part of the resident, and that thermostat controls should only function within the optimal thermal comfort range (i.e., around 20-22 °C).

DISCUSSION

People with dementia may react and respond differently to the indoor climate in comparison with older people without dementia. Current building regulations tend to be primarily written for the needs of older people with a physical impairment (primarily mobility problems), rather than for people with cognitive impairments. Even when recommendations are being made with people with dementia in mind, even these can have short-comings. Even though dementia can significantly change the interpretation of sensing, the extent is highly individual and in constant flux (Bakker, 2003). According to Zeisel (2005), an entire environment should be designed so what people see, hear, touch and smell all give them the same, consistent, information about the environment in a holistic manner to understand the environment around us. The sensitivity of people with dementia stretches beyond sensitivity for actual physical conditions, for instance, to operational factors. Invasive technology, like curtains moving, and noisy ventilation

systems can cause distress. There is need for more indoor environmental research in relation to older adults and people with dementia for both home and institutional settings. Until there is more evidence on the needs of people with dementia in relation to the indoor environment, the process of modifying the indoor environment often relies on trial and error. Warner (2000, p. 20) provides a good example; “*Try to discover [the] comfort zone. It’s probably not the same as yours. Consider the home’s temperature, lighting, and sounds [..]. Be extra-sensitive in doing so – even the motion or [draught] from a ceiling fan can be annoying. Your [partner] may not know what is wrong, only feel uncomfortable. [The] only means of expression may be agitation or desperate efforts to escape the discomfort*”. As we all try to understand the implications of dementia, we can try to create suitable indoor environments for this group of people.

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