

Commentary

Seniors may need a “Home, Sweet, (Cozy-Warm) Home” in Winter for Better Brain Health

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Abstract

Low temperatures appear to influence hyperphosphorylation of tau and thus might initiate tauopathies in the elderly who have declining thermoregulatory abilities. Could fuel poverty and cold homes in winter be to blame for a portion of the incidence of dementia? Continuing to improve home heating technologies and research on affordable, dependable, clean energy sources are social justice issues.

Introduction

Thirty-six million people worldwide have some form of dementia [1]. Alzheimer’s disease is the most common form of dementia. An estimated 26 million people worldwide, 5.3 million Americans, and 26,000 Delawareans have Alzheimer’s disease and require healthcare expenditures that far exceed those for individuals without dementia (Carrettiero, Saniago, Motzko-Soares, Almeida, 2015) [2,3]. Dementia costs are an estimated US\$604 billion worldwide [1]. Add to that, caregiver burden [4]. Add to that, aspirations for the future forgone. Therefore, research into prevention of Alzheimer’s disease and other dementias has become an area of intense focus [5]. Tauopathies are involved in various neurodegenerative diseases including Alzheimer’s disease [6,7]. Hyperphosphorylated tau protein appears to contribute to neurodegeneration at multiple molecular levels including: the synapse, axonal transport, microtubules, cell cycle, oxidative stress, DNA, and epigenetic changes. This raises the question: what influences the hyperphosphorylation of tau? And what can be done to reduce the risk?

Hyperphosphorylation of Tau and Temperature

Animal studies have revealed that exposure to cold temperatures can trigger the hyperphosphorylation of tau in the brain and result in cognitive impairment (Carrettiero, et al, 2015) [8,9,10]. Chronic exposure to cold temperatures may have lasting effects on the brain [8]. However, in a mouse model of Alzheimer’s disease (3xTg-AD), exposure to a thermoneutral environment for a week attenuated deficits in object recognition [11]. Older individuals may be more susceptible to this due to declining thermoregulatory abilities [10,12,13]. The elderly often have lower body temperatures due to declines in thermoregulatory processes - including cardiovascular, respiratory, neuromuscular and gastrointestinal functions - and possible malnutrition and medication side-effects [13].

Fuel Poverty and Cold Homes

Although stories vary, too many people, even in some of the wealthiest countries, have difficulties paying basic expenses such

as utilities [14, 15,16]. The problems of inadequate home heating and fuel poverty have been identified in a number of countries [17,18,19,16,20,21]. In England, the homes of one in six older adults, aged 50 and older, are too cold for healthy living [19]. There are other factors, in addition to fuel poverty, that contribute to this [20]. For example, some elders pride themselves in being stoic and frugal, and they might also lack information about the importance of staying warm in winter and heating technology [20].

Could Cold Homes Contribute Some fraction to the Rate of Dementia?

Is there evidence that environmental temperature influences dementia risk? From research on geographical differences in dementia mortality, it appears that latitude and thus climate might be one of the variables, with some colder climates showing higher rates [22]. This might be in part due to levels of vitamin D production from sunshine, but could the temperature itself play a role? Warmth might reduce the risk. Sauna bathing has been associated with a lower risk of dementia [23]. Could individual predisposition to thermoregulatory deficits influence Alzheimer’s disease risk? Down’s syndrome adults, for example, have lower average body temperatures [13]. Could this be, in part, why they go on to develop early-onset Alzheimer’s disease [13]?

The Good News about Home Heating and Alzheimer’s Prevalence

There have been some reports that the proportion of the elder population who suffer from dementia might be decreasing in western countries [24,25]. This has been attributed to the cognitive health effects of more education, reduced risk factors, and healthier lifestyles [24]. Could an additional factor be improved heating technology leading to warmer indoor temperatures in winter [26]? This might point to the importance of continual research and improvement of home heating technology and affordable, dependable, clean energy sources.

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