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Relationship Between Indoor Air Temperatures And Energy Bills For Low Income Homes In Australia

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Abstract

Energy poverty is a prevalent issue in Australia and other countries across the globe especially for people with a low income. This paper seeks to investigate the relationship of energy consumption and indoor air temperatures and is separated into 3 sections; a comparison of actual electricity consumption to energy benchmarks provided by the Australian Energy Regulator, monitoring results of living room air temperature for the winter of 2015, and an analysis of living room air temperatures versus electricity consumption. The results of a comparison of electricity consumption of 119 low income elderly peoples (60+) dwellings to that of the energy benchmarks found that over 75% of the Independent Living Units consumed less electricity than the benchmark values with some households consuming less than half of the benchmarked electricity values. The analysis of living room air temperatures found that approximately 10 % of the dwellings experienced temperatures below 16°C for over 65% of the total hours for the winter of 2015 with some as high as 95% of the total hours. The results of this paper highlight a need to investigate this cohort separate from the average Australian cohort as their energy consumption practices can vary greatly and impact their living room air temperature.

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1. Introduction

Since the 1980's the concept of fuel or energy poverty as it is commonly referred to in Australia and how to define and measure it has been discussed and debated [1,2]. Until 2013 the UK defined fuel poverty as when 10% or more of a household's income would need to be spent to provide a comfortable and safe temperature level within the dwelling which was defined as 21°C for the living room and 18°C for other occupied rooms [3]. Following the Hills review [2], the UK has since revised this definition to the Low Income High Cost (LIHC) which has since sparked further debate [4]. In Australia a formal definition of fuel poverty has not been given, however, a recent paper provided five definitions with the estimated percentage of households living in energy poverty varying from 2% to 14% depending on the definition [5]. A key finding of this paper was that Aged pensioners have a higher likelihood of experiencing energy poverty along with those who live in dual fuel households (mains or bottled gas) [5].

Although many measures and definitions of energy poverty exclude the need to be able to heat the home to a comfortable and healthy level, these effects need to be considered when making policy decisions. The study presented in this paper was conducted as part of the Energy + Illawarra project which sought to improve the energy efficiency of the houses of 800 elderly (aged 60 years or older), low income people whilst maintaining or improving their thermal comfort. This was achieved through a multidisciplinary approach involving social marketers, human geographers and engineers. Within the Energy + Illawarra project, a building characterization and retrofit program was undertaken that targeted 200 dwellings. Energy consumption data was collected for each of these dwellings and 170 received air temperature monitoring of their primary living room.

Similar studies that have been conducted in the past include the HEEP study which involved 397 dwellings across New Zealand and installed 774 living room temperature sensors, 380 bedroom temperature sensors, 37 external temperatures and 30 other room temperatures across the cohort. This study discovered fuel poverty issues with those of lower income experiencing lower mean living room temperatures and expending a larger proportion of their income on winter heating [6,7].

The aim of this paper is to investigate the relationship of energy consumption and indoor air temperatures for 119 low income households from the Illawarra region in Australia that were part of the Energy + Illawarra project. The paper is separated into 3 sections; a comparison of actual electricity consumption to energy benchmarks provided by the Australian Energy Regulator, monitoring results of living room air temperature for the winter of 2015, and an analysis of living room air temperatures versus electricity consumption.

Nomenclature

AER	Australian Energy Regulator
CDD	Cooling Degree Days
HDD	Heating Degree Days
Own	Owner occupied dwelling
ILU	Independent living unit located within retirement villages
n	Household sample size

2. Methodology

2.1. Energy benchmarking

Gas and electricity billing data was sourced from local energy distributors for the period of March 2013 to March 2016. For the Illawarra region in Australia and for the majority of Australia this data is collected via manual meter reads that occur at three monthly intervals. This places meter read dates at any period throughout the year and thus inhibits the direct separation of the data into seasons. This issue is referred to as 'billing lag' [8]. To mitigate the effects of this lag on results and to enable a direct comparison to the energy benchmarks to be made, the methodology applied in the ACEL Allen Consulting report was employed [8]. This method calculates the mid-date of the billing period (three months in our case) and assigns the season of this date to this billing period.

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