

Modelling the impact of fuel poverty and energy efficiency on health

Research Summary

This research project aimed to contribute to the evidence on the impact of fuel poverty policies on health at the population level. The project used secondary data analyses to investigate the links between household fuel poverty, home energy efficiency improvements and risk of hospital admissions for respiratory and cardiovascular diseases at the area-level.

Introduction

Fuel poverty poses a distinct societal and healthcare burden. Official fuel poverty statistics show that around 11% of households in England are affected. These health and housing inequalities persist despite acknowledging that cold homes increase the risk of damp and cold-related morbidity and mortality. This has been articulated in a number of landmark publications such as the 1980 Black Report, the 1998 Acheson Report and the 2010 Marmot Report, which called for improved household energy efficiency across the social gradient. Well-designed home energy efficiency improvements (e.g. sealing homes to prevent heat loss, improved insulation, glazing, heating and ventilation) have the potential to reduce the cost of heating homes and improve people's health and wellbeing. However, policies supporting increased energy efficiency schemes are continuing without fully understanding the health benefits or the extent of some unintended consequences such as reduced air quality in unventilated homes. Furthermore, there is a lack of evidence at the population level linking historic energy efficiency interventions with health outcomes at the population-level; the focus of this pilot exploratory project.

Aims and objectives

In this novel exploratory pilot study, with partners from health, energy efficiency and academic organisations, we aimed to utilise population-level secondary data analysis techniques to explore the relationships between fuel poverty/home energy efficiency and hospital admission rates for cardiovascular and respiratory diseases across England. The primary objectives were to:

1. investigate how area-level household energy efficiency is associated with hospital admission rates for cardiovascular and respiratory diseases at national population scale; and
2. utilise detailed dwelling-level data on 500,000 homes in Devon to assess the association between home energy efficiency measures and risk of fuel poverty, and hospital admission rates.

Methods

Given this study involved the use of hospital admissions data and linkage with other datasets at a fine geographical resolution, we obtained ethical and information governance approval. Overall ethical approval was obtained from the University of Exeter Medical School Research Ethics Committee (ref FEB17/D/119). Analyses of the Devon

hospital admissions data were approved under the Information Governance procedures of the NHS NEW Devon Clinical Commissioning Group.

The study comprised two streams of analysis with similar approaches, both capitalising on existing (secondary) population data resources. The first analysis made use of national (England) data on home energy efficiency, and related this to hospital admissions for relevant health outcomes (asthma, Chronic Obstructive Pulmonary Disease (COPD), and Cardiovascular Disease (CVD)). The second analysis used a novel property-level dataset for the county of Devon on home energy efficiency and fuel poverty (aggregated to small area level), and again investigated associations with hospital admissions.

The approach for each analysis was to carry out a small-area (Local Super Output Area), ecological cross-sectional study. This approach integrates a number of datasets based on common geography, and investigates associations between area-level measures (e.g. the average energy performance of homes and the hospital admission rate within an area). The approach is powerful in that it used population-scale data, and was able to geographically integrate a large number of additional data sources (such as weather and air pollution). However, there were design limitations, including the lack of individual exposure measures, and the inability to investigate change over time (e.g. to look at outcomes before/after energy efficiency intervention).

Overview of results

A range of limitations restricted the ability of these analyses to indicate causal associations between area energy efficiency metrics and hospital admission rates. In general, there were quite mixed findings regarding the key relationships of interest. There were a number

of instances in both the national and local analyses where there was a suggestion of a positive association, i.e. higher admission rates in areas where average home energy efficiency was greater. There were a smaller number of instances where an inverse association was observed.

Some of the clearest findings were a small but significant association of around a 0.5 to 1.0% increase in hospital admission rates for asthma, COPD and CVD per one point increase in the mean EPC (rating assessed by Energy Performance Certificates) rating across England in the national analyses. The Devon analysis suggested that higher average SAP rating (i.e. higher % properties rated A-C) at the postcode-level were associated with higher admission rates for asthma, COPD and CVD. However, these associations disappeared in models that adjusted for all other factors. Also in the Devon analysis, the higher probability of fuel poverty was associated with lower admission rates for CVD in fully adjusted models, but there were some specific limitations of use of this variable in adjusted models.

It is possible that the area-level analyses and the health outcome definitions in this study concealed the potential benefits of energy efficiency measures in more vulnerable populations (i.e. those residing in cold homes and/or with a chronic disease). The study design only considers relationships at the aggregate (area) level, based on 'average' measures of housing energy efficiency and population hospital admission rates; it cannot reveal relationships between individual home conditions and individual-level hospital admissions.

The study findings could, in part, be due to reverse causality, where people suffering from chronic diseases may be more likely to make energy efficiency improvements to their

homes. They could also possibly be explained if areas with historically poor housing conditions have been targeted for retrofitted efficiency improvements. Consequently an underlying association between poor housing conditions and poor health could generate apparent relationships between energy efficiency measures and higher hospital admission rates as observed here.

In terms of local climatic conditions, minimum winter temperatures appeared to generally be associated with the rate of hospital admissions for asthma, COPD and CVD across Devon in the expected direction (i.e. milder winter temperatures were associated with fewer admissions). In the national analyses, this association was only clearly observed for COPD admissions.

Summary Points

What is already known?

Well-designed household energy efficiency improvements are an essential national policy for alleviating the societal and healthcare burden of fuel poverty and associated cold related morbidity and mortality. These are particularly effective when targeting vulnerable populations such as those unable to adequately heat the home and/or those with a chronic respiratory disease. However, there is some existing evidence from prior studies that some poorly designed and unregulated home improvements can have a negative impact on residents' health, which could be a result of issues such as reduced indoor air quality.

Drawing on international examples of effective energy efficiency schemes, future policy and funding programmes need to support the adoption of more sustainable energy efficiency schemes, which could focus on those aspects of previous interventions that have resulted in consistent health improvements. These include: energy efficiency schemes with the adoption of greener non-polluting building materials;

improved ventilation strategies such as the use and maintenance of mechanical or passive ventilation with heat recovery approaches; and behavioural approaches such as resident training. Resident training should incorporate follow-up home visits with a focus on different awareness levels, motivations, values, beliefs and coping strategies.

What does this study add?

Whilst subject to design limitations, this study suggests that populations living in areas with higher average energy efficiency may experience higher hospital admission rates. While there are alternative explanations, it is possible that previous unmonitored blanket approaches and inconsistent delivery mechanisms for energy efficiency improvements (e.g. focusing on area-level schemes with individual measures) may have failed to deliver significant net population health improvements. The study adds to the body of literature supporting the need for better designed home improvement funding schemes and higher quality measures that address the whole property.

From a research point of view, the findings support the need for larger scale, longitudinal natural experiments and/or more complex study designs that can account for individual-level resident and building characteristics. These studies should also further investigate the impact of historic energy efficiency measures and variations in the quality of these housing upgrades on health across the life-course, from childhood to older age.

Further development of fuel poverty models such as the [Energy Saving Trust's Home Analytics Portal](#) may hold promise for targeting vulnerable populations and benefiting health and social care. However, concomitant cost-benefit analyses of these approaches are required. This further highlights the need for greater inter-sectoral

collaborations between a range of health and housing stakeholders.

Project outputs

- Project presented at Public Health England conference (September 2017) and research conference (University of Exeter Medical School, 2017).
- Energy Saving Trust blog: <http://www.energysavingtrust.org.uk/blog/testing-association-between-homes-and-health>.
- In Cornwall, the results from the project have influenced the development of a [fuel poverty toolkit](#), the Directors of Public Health's annual report and a successful health and housing round table event with key academic and non-academic stakeholders.
- The study helped inform the development of a large European Structure Investment Funded project worth 4.5 million Euros (the [Smartline project](#)).
- Peer-reviewed publications based on the project are in progress.

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Project information

The full project report can be downloaded at:

□ www.eagacharitabletrust.org/modelling-impact-fuel-poverty-energy-efficiency-health/

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