The INHERIT project (2016-2019), coordinated by EuroHealthNet, has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 667364

Retrospective Study on Energy Efficiency in the UK
George Morris, on behalf of Tim Taylor (UNEXE)
Background

- Based on recent work with Energy Saving Trust funded by EAGA charity
- This evaluated impact of energy efficiency in an ecological study of hospital episode statistics on cardiovascular disease, COPD and asthma.
Why examine energy efficiency in the UK?

• Potential “triple win”:
  – Health improvement anticipated (via warmer homes, reduced emissions)
  – Environmental improvement – carbon savings
  – Health equity gain as many measures targeted to social housing or to lower income groups
Methodology: Health impacts

Ecological study linking small-area, whole population data on housing energy efficiency and hospital admissions. Two streams:

=> Analysis at Lower-layer Super Output Area (LSOA) level for England.

=> Analysis of higher resolution postcode level data for one area of south west England (Devon).
HEED data (UK wide)

• Includes data on:
  – Loft insulation
  – Wall insulation
  – Glazing type
  – Draught proofing
  – Boiler replacement
  – Property age

• Count data on buildings with certain types of energy efficiency measures (used at LSOA level)
EST Home Analytics - Devon

• Similar household-level data available from the Energy Saving Trust Home Analytics (HA) Portal.

• Aggregated to postcode level
### Selected initial results: Risk ratios associated with energy efficiency

<table>
<thead>
<tr>
<th>Total 3 year admissions</th>
<th>Crude model</th>
<th>Fully adjusted model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RR</td>
<td>95% CI</td>
</tr>
<tr>
<td><strong>Asthma</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loft insulation</td>
<td>1.011</td>
<td>[1.010,1.011]</td>
</tr>
<tr>
<td>Wall insulation</td>
<td>1.006</td>
<td>[1.003,1.008]</td>
</tr>
<tr>
<td>Full double/triple glazing</td>
<td>1.001</td>
<td>[1.000,1.003]</td>
</tr>
<tr>
<td>Rate of draught proofing measures</td>
<td>1.005</td>
<td>[1.004,1.005]</td>
</tr>
<tr>
<td>Rate of boiler replacement measures</td>
<td>1.027</td>
<td>[1.018,1.035]</td>
</tr>
<tr>
<td><strong>COPD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loft insulation</td>
<td>1.012</td>
<td>[1.011,1.013]</td>
</tr>
<tr>
<td>Wall insulation</td>
<td>1.008</td>
<td>[1.005,1.011]</td>
</tr>
<tr>
<td>Full double/triple glazing</td>
<td>1.004</td>
<td>[1.002,1.007]</td>
</tr>
<tr>
<td>Rate of draught proofing measures</td>
<td>1.011</td>
<td>[1.010,1.012]</td>
</tr>
<tr>
<td>Rate of boiler replacement measures</td>
<td>1.038</td>
<td>[1.028,1.048]</td>
</tr>
<tr>
<td><strong>CVD</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loft insulation</td>
<td>1.010</td>
<td>[1.010,1.011]</td>
</tr>
<tr>
<td>Wall insulation</td>
<td>1.004</td>
<td>[1.002,1.006]</td>
</tr>
<tr>
<td>Full double/triple glazing</td>
<td>0.999</td>
<td>[0.998,1.000]</td>
</tr>
<tr>
<td>Rate of draught proofing measures</td>
<td>1.003</td>
<td>[1.003,1.004]</td>
</tr>
<tr>
<td>Rate of boiler replacement measures</td>
<td>1.028</td>
<td>[1.020,1.036]</td>
</tr>
</tbody>
</table>

Some measures positive, others negative...

Supports “sealing” hypothesis

Open question: Were these measures good or bad overall for health?

Source: Sharpe et al (in prep)
Costs and benefits

Investment costs -
O and M -
Externalities from energy use reduction +

Energy savings +  Do the costs outweigh the benefits?
Health impacts +/−  Watch this space....
Carbon benefits +
Ultimately whole house solutions needed to ensure “triple wins”

**Drivers**
- High levels of fuel poverty
- Climate change
- Historic housing and antiquated construction techniques
- Availability of affordable energy e.g. in off-gas areas
- Historic, socio-cultural influences
- Rising energy costs
- Rural and isolated properties
- Differences across tenures (e.g. housing standards)

**Pressures**
- Resident lifestyles and behaviours
- Poorly designed energy efficiency measures
- Regulation of energy efficiency installers
- Changes in temperature, precipitation and humidity
- Funding mechanisms and eligibility criteria’s
- Uptake and acceptance
- Knowledge and risk perception
- Overcrowding and space inequalities

**States**
- Availability of affordable and safe homes
- Changes in indoor air quality
- Heating and ventilation patterns & lifestyles
- Reduced ventilation rates
- Type and age of heating and ventilation systems

**Exposures**
- Indoor temperature e.g. cold homes
- Increased damp and condensation
- Increased carbon monoxide and nitrogen dioxide
- Particulates and volatile organic compounds
- Mould and bacteria levels

**Effects**
- Allergies, asthma and other respiratory conditions
- Chronic obstructive pulmonary disorder
- Increased cardiovascular disease

**Domestic carbon footprint & fuel poverty**
- Governmental policy to achieve the co-benefits of reducing the carbon foot print and fuel poverty alleviation

**Actions**
- Building standards for home upgrades
- Resident training with interventions
- Improve property maintenance

**Context**
- Fuel poverty funding mechanisms, delivery and implementation of energy efficiency improvements and interaction with resident lifestyles and behaviours

Source: Sharpe et al (2018)
Take home messages

• Energy efficiency measures *might* lead to triple wins if they were appropriately designed to avoid sealing and other risks.

• In terms of interventions in the recent past, the picture is not clear.

• Caution – this analysis based on ecological study.
Thanks for listening

Thanks also to Richard Sharpe, Ben Wheeler, Ian Hutchcroft and other members of the team.
Possible extension...

- Net zero energy retrofit in Social Housing – Energiesprong UK
- Aims to retrofit social housing to a net zero energy standard (for example through insulation, renewable electricity and heat generation).
- It is a “whole house” aiming to deliver fully integrated net zero energy refurbishment packages, supported by long-term performance guarantees aiming to make the solution commercially financeable.
Conceptual model

National-level analyses aggregated to LSOA–level using data from HEED

Average area-level household energy efficiency measures

Resident behaviours, household maintenance characteristics, heating & ventilation strategies

Risk of indoor damp & condensation

Presence of indoor mould growth, HDM, VOCs & bacteria

Resident health: asthma, COPD & cardiovascular diseases

Disease exacerbation: risk of hospital admission

Other gene, outdoor risk factors & ambient environmental conditions affecting health

National-level analyses using HES data (ICD-10 codes J40 to J46, I11, I20-24 & I60-69)

Local-level analyses aggregated to postcode – level: data from the Home Analytics Portal

Local-level analyses emergency admissions data from NEWCCG data (ICD-10 codes J40 to J46, I11, I20-24 & I60-69)
Hospital admissions data

- Emergency (i.e. unplanned) inpatient admissions relating to the following outcomes were included in both analyses:
  - Asthma (ICD-10 codes J45 & J46)
  - Emphysema & chronic bronchitis, Chronic Obstructive Pulmonary Disease (COPD, ICD-10 J40-J44)
  - Cardiovascular Disease (CVD), comprising hypertensive heart disease (I11), acute stroke (I60-69) & ischemic heart disease (excluding chronic) (I20-24)