

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

Total 3 year admissions	Crude model			Fully adjusted model		
	RR	95% CI	р	RR	95% CI	р
Asthma						
Loft insulation ^a	1.011	[1.010,1.011]	<0.001	1.004	[1.004,1.005]	<0.001
Wall insulation ^b	1.006	[1.003,1.008]	<0.001	1.000	[0.998,1.002]	0.798
Full double/triple glazing ^c	1.001	[1.000,1.003]	0.115	0.999	[0.997,1.000]	0.128
Rate of draught proofing measures ^d	1.005	[1.004,1.005]	< 0.001	1.000	[0.999,1.001]	0.814
Rate of boiler replacement measures ^e	1.027	[1.018,1.035]	<0.001	0.998	[0.994,1.002]	0.398
COPD						
Loft insulation ^a	1.012	[1.011,1.013]	< 0.001	1.002	[1.001,1.003]	<0.001
Wall insulation ^b	1.008	[1.005,1.011]	<0.001	1.002	[0.999,1.004]	0.155
Full double/triple glazing ^c	1.004	[1.002,1.007]	0.001	0.999	[0.998,1.001]	0.476
Rate of draught proofing measures ^d	1.011	[1.010,1.012]	< 0.001	1.002	[1.002,1.003]	<0.001
Rate of boiler replacement measures ^e	1.038	[1.028,1.048]	<0.001	0.992	[0.987,0.996]	0.001
CVD						
Loft insulation ^a	1.010	[1.010,1.011]	<0.001	1.004	[1.003,1.004]	<0.001
Wall insulation ^b	1.004	[1.002,1.006]	< 0.001	0.999	[0.998,1.001]	0.356
Full double/triple glazing ^c	0.999	[0.998,1.000]	0.175	0.999	[0.998,1.000]	0.011
Rate of draught proofing measures ^d	1.003	[1.003,1.004]	<0.001	1.000	[1.000,1.001]	0.282
Rate of boiler replacement measures e	1.028	[1.020,1.036]	<0.001	1.000	[0.996,1.004]	0.935

Some measures positive, others negative...

Supports "sealing" hypothesis

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

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Source: Sharpe et al (in prep)

Costs and benefits

Investment costs -

O and M -

Externalities from energy use reduction +

Energy savings +

Health impacts +/-

Carbon benefits +

Do the costs outweigh the benefits?

Watch this space....

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, sociocultural 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

Home maintenance

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

Sustainable green building materials

Resident behaviour change

Energy policy Flexible fuel poverty funding

Improve both heating and ventilation

Actions

Building standards for home upgrades

Resident training with interventions

Improve property maintenance

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Domestic carbon footprint & fuel poverty

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

Context

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

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

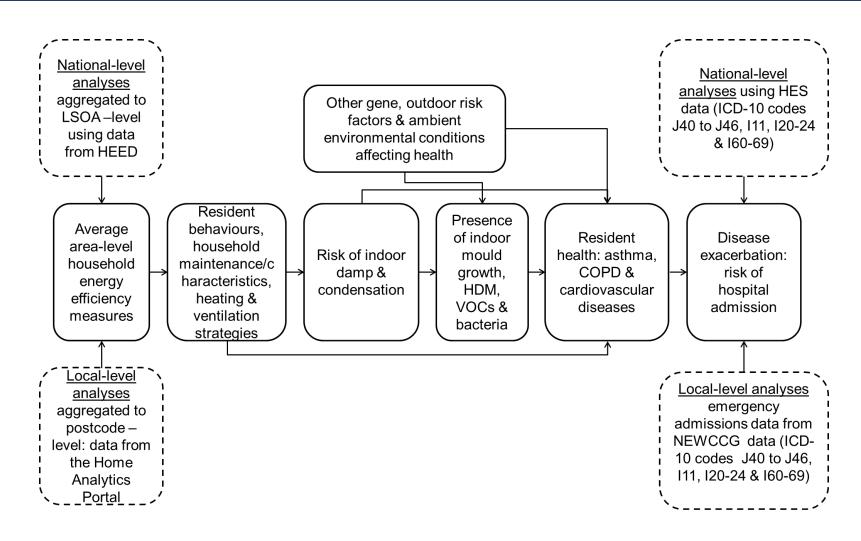
Thanks also to Richard Sharpe, Ben Wheeler, Ian Hutchcroft and other members of the team.



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



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)