Section A: CPHE to complete	
Name:	Christine Liddell
Job title:	Professor of Psychology
Address:	University of Ulster Cromore Road Coleraine, Northern Ireland BT53 8BZ
Guidance title:	
Committee:	Cold Homes and Excess Winter Deaths
Subject of expert testimony:	Cold Homes and Children
Evidence gaps or uncertainties:	[Please list the research questions or evidence uncertainties that the testimony should address]

- What is the evidence base concerning the associations between living in a cold home and children's health/wellbeing?

Section B: Expert to complete	
Summary testimony:	[Please use the space below to summarise your testimony in 250 – 1000 words – continue over page if necessary]

Caveats

There are significant ethical constraints when exploring the impacts of cold homes on children's health and wellbeing. Almost none of the evidence is based on clinical assessments of children's health status before and after retrofit; some evidence is drawn from children's own symptom and treatment diaries, but parental report is largely relied upon. Since parents themselves experience the benefits of a warmer home, and may also experience improved health/wellbeing as a result, there are opportunities for confounding, in which the disposition of parents improves and children feel less troubled by ailments as a result; even if children are still equally symptomatic post-retrofit, parents may view this as less burdensome given their own health/wellbeing improvements. Only one study (one of the two strongest methodologically) gathered lung function test data from asthmatic children before and after retrofit; there were no significant improvements. However, follow-up intervals were short and lung function may have taken longer to improve than could be accommodated in the trial.

There is also extensive anecdotal evidence that caregivers protect children from cold homes as much as possible, which may minimise potential health impacts. Heating is left off throughout winters whilst children are at school, only being turned on to warm up in time for their return (O'Sulllivan et al. 2011). The greatest prevalence of energy-related debt is also found in families with young children, especially those with a

single caregiver, with parents expressing the view that a warm home is non-negotiable where their children are concerned (e.g. Harrington et al., 2005). Thus, children's exposure to the worst of cold indoor temperatures may be somewhat more limited than the exposure of adults, with consequences for what might be expected from a dose-response effect.

Effects may also be mitigated by the fact that changes in home conditions were often rather modest post-retrofit. Although studies which measured changes in temperature, mould and damp post-retrofit all confirm improvements, these are often modest. For example in one of the 2 New Zealand studies, indoor temperatures improved by 1^0C, to an average of 17^0C; this remains below the WHO recommended safe temperatures for bedrooms (18^0C) and considerably below that for living rooms (21^0C). That is, homes remained cold inside.

Findings

The recent Cochrane Review from Thomson and colleagues cites 6 quantitative studies of sufficient quality. A similar review by Maidment et al. cites 20 studies (which include the 6 selected by Thomson's team). Of these six core studies:

- two are randomised controlled trials of sufficient size and quality, and both of these report significant perceived improvements in children's respiratory health (including child and parent reports of wheezing, disturbed sleep, coughing, and days off school). The odds ratio's for significant effects are impressive ranging from 0.48 to 0.59. (Howden-Chapman et al., 2007; 2008). However, the children involved in these 2 studies were the same children, first given insulation (Study 1), and then given heating (Study 2); Study 2 children were a subset chosen because they all had asthma. As already mentioned lung function showed no significant change in Study 2.

- two studies were not RCT's but were of high scientific quality; neither found impacts on children's health or mental wellbeing (CHARISMA and Barton studies);

- two studies were of less scientific rigour; one (Somerville) reported a wide range of statistically significant improvements in areas such as coughing, wheezing and blocked nose, and also fewer days off school as a result of asthma. The other (Hopton) reported scattered but inconsistent significant effects, not all of them in the expected direction.

Maidment and colleagues consider a wider range of studies than the Cochrane

Review, not all of them of especially high standard, but they evaluate where the greater impacts of retrofits might be located. They use a universal currency of effect sizes (or d values), in which

- values approximating 0.20 are classically considered small but measurable,
- values around 0.5 are medium effects,
- and values around 0.8 are large.

They conclude that the effects of improving domestic energy efficiency are uniformly small but often significant; they are greater for children (d = 0.08) than for healthy adults, greater still for people in poor health (d = 0.13) and even greater among low income households (d = 0.15).

In another line of enquiry, improving the affordability of heating was associated with improved child outcomes. When many other factors had been accounted for (e.g. mother's education, ethnicity, marital status, employment, etc.), infants from low-income families who received a winter fuel subsidy (a sample of more than 1,000 infants in the USA) had significantly higher weight-for-age scores and lower nutritional risk for depressed growth than did those from homes without a fuel subsidy. They also had lower odds for attending emergency paediatric units, and were rated by caregivers as being in better health and of more advanced developmental status (Frank et al., 2006). Since infancy is a period of rapid growth, it is also a period of high calorific need. Children in homes without winter fuel subsidy were found to consume fewer calories than subsidised infants (Cook and Frank, 2008). This corroborated research using data from the USA National Health and Nutrition Examination Survey to examine winter resource shifts, i.e. the extent to which drops in temperature were associated with changes in how much households spent on food and heating (Bhattacharya et al., 2003). During winter, low-income households showed significant decreases in calorie intake which equated with a 10% reduction in food intake for both children and adults. By contrast, higher-income households increased their spend on both heating and food during temperature shortfalls, maintaining the same levels of food intake year-round.

Evidence concerning birth-weight and outdoor ambient temperatures is potentially relevant, but difficult to interpret. There are, however, many consistent studies. Effects of mothers' exposure to cold tend to be small, but statistically significant : cold temperatures are associated with lower birth-weights averaging 25-35g. Heat exposure effects are greater. Most studies in this area conclude that mothers should be protected from the "extremes" of local ambient temperatures during pregnancy.

Strand and colleagues (2011) provide a useful review of the evidence.

Summary of associations between cold housing and children's health

Ethical constraints limit how much we know about the impacts of cold indoor temperatures on infants and young children. Unlike many other vulnerable groups, this group may often be protected from the impacts of the coldest indoor temperatures, and so impacts on their health and wellbeing may be ameliorated. Evidence from

- one high quality RCT done in 2 stages
- one of four other intervention studies (possibly two of four)
- one study examining the impact of fuel subsidies on children's health
- and several studies examining the relationship between birth-weight and maternal exposure to cold

all coalesce around statistically significant impacts with small effect sizes.

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