

Review #3

Is there a significant relationship between fuel poverty and mental or physical well-being?

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Background. It was agreed that the review would focus on systematic reviews of the literature only, given the volume of literature in the area. It was further agreed that studies examining the relationship between fuel poverty and health in low and middle-income countries would be excluded.

Searches were conducted in Web of Science, and Scopus.

Overall, this is a particularly heterogenous literature, with multiple ways of assessing health outcomes in terms of particular measures or scales, and multiple ways of assessing fuel poverty-related markers or indicators.

Fuel/energy poverty: *“(the) inability to attain a socially and materially necessitated level of domestic energy”*.

Bouzarovski & Petrova, 2015 (p.31)

“Improvements in warmth and affordable warmth may be an important reason for improved health. Improved health may also lead to reduced absences from school or work. Improvements in energy efficiency and provision of affordable warmth may allow householders to heat more rooms in the house and increase the amount of usable space in the home. Greater usable living space may lead to more use of the home, allow increased levels of privacy, and help with relationships within the home. An overview of the best available research evidence suggests that housing which promotes good health needs to be an appropriate size to meet household needs, and be affordable to maintain a comfortable indoor temperature”.

Thomson et al., 2013 (p.3)

So-called ‘fuel poverty’ has been examined in the scientific literature for over a century, and has been variously described as *energy poverty*, *energy vulnerability*, or *energy insecurity*. In practice, it is said to reflect a situation in which households, or individuals, cannot attain and/or use the energy services required for good health, wellbeing, and the ability to fully participate in society, with implications for household temperature, the ability to cook hot meals, wash clothes or take a

warm shower. The antecedents of fuel poverty are many and varied, with some of the main ones displayed in Table 1. These can occur singularly, or in combination. The impact of fuel poverty has been well-documented, and additional to the detrimental impacts on physical and mental health, some have also suggested that it can negatively impact on outcomes such as children’s educational attainment.

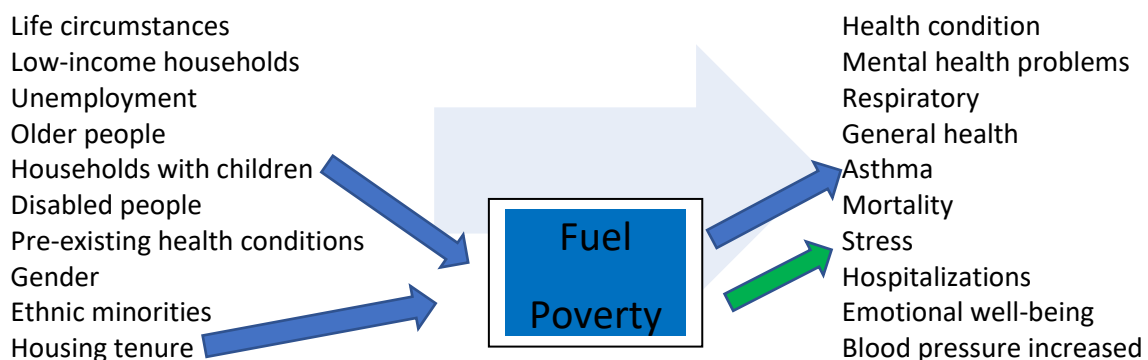
Previous research has defined vulnerability as comprising three interlinked dimensions: (i) (Risk of) Exposure: the likelihood and degree to which an individual, household or community will encounter fuel poverty; (ii) Sensitivity: the degree to which exposure to fuel poverty will lead to a loss of wellbeing; and (iii) Adaptive Capacity: the degree to which those exposed to fuel poverty are able to plan, respond and recover.

Table 1. <i>Antecedents of, or risk factors for fuel poverty.</i>	
Risk factor	Rationale. (Variables overlapping different risk domains are colour coded).
(1) Low-income households	Fewer economic resources; Increased likelihood of living on poorer quality, less energy efficient houses; credit worthiness to be able to afford material improvements; more likely to be on more expensive energy tariffs (e.g., pre-paid meters) .
(2) Unemployment	Partly due to low income ; Typically spend more time at home, ergo greater energy usage , or other costs. Necessitating rationing of energy usage.
(3) Older people	Low income ; Females particularly disadvantaged (smaller pensions); may require heating on for longer (spending more time at home) ; This in turn has implications for frailty and poorer health; Barriers resulting from ‘smart’ technologies (tech illiteracy) ; Limited information; Subjective life expectancy; May not seek assistance (‘old and frail’ stereotyping); May not consider circumstances ‘problematic’.
(4) Households with children	May need to heat multiple rooms ; Additional appliance usage (e.g., washing machines/dishwashers); Stable routines may exclude possibility if benefiting from, for example, off-peak tariffs.
(5) Disabled people	Surprisingly little empirical research; Multiplicative effect of disability and pre-existing illness; Lower incomes ; Barriers to employment; Required to heat homes for longer hours ; Disability-related expenditure impacting resources for energy. Further research needed on heterogenous nature of disability -> fuel poverty.
(6) Pre-existing health conditions	Requires high and consistent temperatures; May depend on energy for medical devices ; Mobility issues leading to more time at home ; Heterogeneity issues, as above (circulatory, respiratory, terminal particularly energy intensive); Mental ill-health impacting on ability to manage energy complexity and engagement with energy suppliers.
(7) Gender	Women particularly disadvantaged, although small number of studies; Fuel poverty typically studied as a ‘household’ issue; Households where women are primary earner particularly vulnerable (structural disadvantage in labour market) ; Older widowed or single females (smaller pensions) .
(8) Ethnic minorities	Most research in USA; Black and Hispanic disadvantage; Research gap in understanding the process of this particular vulnerability.
(9) Housing tenure	Relationships between tenure, and both housing quality and energy efficiency; Low-income tenants facing restrictions on undertaking energy improvement.

There are a variety of risk factors which contribute to a scenario wherein an individual or family is not sufficiently able to deploy enough financial resources to heat their home. Some of the main risk factors are displayed in Table 1. These can occur singularly or in combination. For example, individuals who are unemployed (factor 2) may be parents (factor 4) and will likely be characterised as a low-income home (factor 1).

Fuel poverty may directly and negatively impact health. For example, living in a cold home can directly impact blood pressure, causing chronic raised blood pressure. However, fuel poverty can also impact on health by bringing about infrastructural change which in turn, negatively impacts health. For example, a poorly heated and overly sealed home can be a risk factor for mould, which in turn can negatively impact respiratory health.

In the diagram below, the pale arrow indicates that the life circumstances depicted on the left can potentially impact the health conditions (on the right) without any necessary fuel poverty dimension. Additionally, the green arrow indicates that fuel poverty without any of the particular life circumstances being substantive, can impact a given health condition. For example, a household tied to a particular energy tariff, needing to budget in a particular period of winter may find this particularly stressful, even though they are able to afford the tariff. The blue arrows indicate one example of how fuel poverty might mediate, or exacerbate an already problematic situation, for example, a household with a number of children, living in a poorly insulated private rental situation.



In the present review data were extracted and examined from the studies* in the references section. We provide those extracted data in an accompanying Excel spreadsheet, as well as the manuscripts in an accompanying folder.

Mental Health.

The results for mental health (emotional health; stress; emotional well-being) were relatively clear and consistent, suggesting that home improvements, rehousing initiatives, provision of affordable housing, and green efficiency initiatives were associated with better well-being. However, changes were not always statistically significant, and outcomes were heterogeneously assessed. In a number of studies there was no reported change to mental well-being, and by way of example, these included a housing-led neighbourhood regeneration programme, the provision new affordable housing, and the provision of home improvements.

Overall conclusion: Interventions aimed at providing affordable housing and/or home improvements tended to result in improved mental well-being (variously defined).

Respiratory Health

The Institute of Medicine and the World Health Organization's reviews of the scientific evidence for relationships between damp or mouldy indoor environments and the manifestation of adverse health effects highlighted respiratory and allergic symptoms. In recent decades, many studies have shown associations between indoor exposure to mould and respiratory health issues. Meta-analyses and systematic reviews have provided consistent evidence of relationships between mould exposure and asthma, and the incidence and exacerbation of asthma and rhinitis.

On balance, results for respiratory health (asthma, sinus infection, allergies, bronchitis) show that home improvement interventions which improved insulation, heating efficiency, ventilation, and eradicated damp (and therefore mould) were associated with lower self-reported and/or diagnosed levels of respiratory illness. However, in a number of studies there was no statistically significant relationship identified between socio-economic status, and respiratory disease, while elsewhere evidence was found for a positive impact on some markers (for example asthma), but not others (for example, lifetime-diagnosed bronchitis). In other words, in some cases interventions to offset the impact of fuel poverty can have positive effects on specific indicators of respiratory health, but not others.

Overall conclusion: The majority of evidence presented suggests that fuel poverty, and the material consequences of it (damp, poor ventilation etc) are related to an increased likelihood of respiratory illness. Issues of heterogeneity within the family of respiratory illnesses, as well as study/intervention types, is again an issue in this literature.

Mortality

A small number of studies showed no significant relationship between socio-economic status (a proxy for fuel poverty) and excess winter mortality. However, the majority of studies which reported on this area did suggest that poverty, socio-economic status, and/or poor housing conditions were a significant issue in terms of mortality. More specifically, the effect of cold on mediating factors such as increased blood pressure, and increased likelihood of hospitalisations, was evident in some studies. There was some evidence of gender differences (women more susceptible), and of socio-economic status at its most extreme low, being relevant.

Overall conclusion: The overall *amount* of evidence reported in this area was less than the two areas above. There is no doubt that being colder and living in materially poorer conditions are risk factors for illness and hospital admission.

Physical Health

Of the studies examined, all but one reported a relationship between measures such as home improvements, and green renovation, and better health outcomes. The same caveats apply as previously in terms of heterogeneity of outcome, and intervention. In addition, the number of results examined was relatively low, compared to studies reporting, for example, 'general health' or 'respiratory health'. Of note, there will have been physical health indicators used to in part determine 'general health'.

Overall conclusion: The relatively limited amount of discreet physical health data indicated that interventions which improve living conditions, do have a positive impact on physical health.

General Health

The largest area reported in across studies reviewed concerned 'general health' to include self-rated health, as well as health symptoms. The vast majority of these reported better actual or

perceived general health following interventions of various kinds. Of note, in many of the studies reporting no change in perceived general health, there were positive results found for other indicators including mental health, and specific illnesses including asthma. It is also apparent that these studies also involved general infrastructural changes (cavity wall insulation, provision of grants for energy-efficient light bulbs; macro-level neighbourhood regeneration). It is therefore possible that in studies where there was no improvement in general health observed, the outcomes and markers of improvement were too vague, remote, or non-specific.

Overall conclusion: The vast majority of studies reporting on general health noted potential for improvement, or actual improvements resulting from modifications to homes, or other interventions.

Exposure

A number of studies raised potentially deleterious health-related issues associated with retrofitting, and the addition of heating/home improvements. These largely focussed on problems associated with ventilation as a result of what might be described as over-insulating properties, or increased airtightness. Issues which emerged included increased radon concentrations, increased levels of volatile organic compounds, increased concentrations of dust mite allergens, and increased levels of other airborne chemicals including toluene and benzene. However, retrofits which improved heating efficiency, but which included appropriate and functional ventilation, did not report these exposure-related problems.

Overall conclusion: This is an important consideration. Improvements to homes in order to offset the negative impacts of fuel poverty, may have unintended consequences. Sealing homes to retain heat in a way that negatively impacts on other important health-related infrastructural factors (such as ventilation), can create different risk factors for health.

There is one further variable of consequence in this wider context, namely the location of the home. Inner city living can present related issues of housing costs (rents and mortgages higher), leaving households with less disposable income with which to pay for energy costs. Several of the disadvantaged groups identified in Table 1 tend to concentrate in inner-urban areas (low-income households; ethnic minority and immigrant households; those living in rental housing and/or with transient and precarious housing arrangements, and families with young children, have also been identified as predominantly residing in urban spaces). Conversely, urban housing is often high density (which acts as a form of insulation) and terraced housing often has access to lower-cost heating infrastructure such as natural gas or district heating networks. Again, apartment buildings can also be reliant on expensive electric or solid-fuel heating.

Living in a rural setting brings infrastructural disadvantage. For example, lack of access to nationalised or local networked heating infrastructures (natural gas), leaving households reliant on significantly more expensive heating fuels such as electricity, oil, coal, or other 'solid fuels'. Potential impact of travel distance to deliver oil can further increase prices. Due to less developed and resilient electricity and transport infrastructure, security of supply for electricity and heating fuels can also be problematic in isolated rural areas leading to an increased risk of power cut-offs during periods of bad weather [50]. Additionally, homes in rural areas are also more often detached, thus more expensive to heat due to their greater size and higher surface-to-volume ratio. In many cases they may also be older, 'solid wall' buildings that lack insulation, and can be challenging to insulate due to the financial costs involved and restrictive planning laws.

“Policy makers need to recognise that energy and transport poverty can, and do, overlap and intersect”

Simcock et al., 2021 (p.12)

One further issue arose from this review that might have been somewhat unexpected, and that was the inter-relatedness of fuel poverty and transport poverty. To date, little research has focused on the intersection between these factors. Many of the socio-demographic groups identified as vulnerable to both fuel and transport poverty are said to be at increased risk of exposure to multiple other social and environmental hazards. Likewise, in peripheralised spaces increased vulnerability to fuel and transport poverty often occurs alongside and in combination with many other systemic place-based disadvantages, such as political marginalisation and economic disinvestment. This has been referred to as a **“clustering of disadvantage”**.

Overall conclusions

There is a clear relationship in this literature between the inability to sufficiently heat and maintain a home, the development of deficits therein (including mould and damp), and the subsequent development of mental or physical health problems. The literature reviewed is beset by a number of important issues. Firstly, many of the sample sizes were small. Secondly, there was considerable variation in the ‘predictors’ of ill-health in terms of intervention (e.g., retrofitting), or housing conditions (e.g., mould). In other words, fuel-poverty-related risk factors or mitigations varied greatly. Thirdly, there was considerable variation in the National and specifically local settings for studies. Finally, there was considerable variation in the ways in which health outcomes were assessed. Despite these caveats, there appears to be considerable evidence for the relationship between fuel poverty (antecedents or sequelae thereof) and poorer health outcomes, particularly in the areas of mental/emotional health, respiratory health, and to a less clear degree for so-called ‘general health’.

Potential References of Interest

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