Health and Care Research Wales Evidence Centre Rapid Review – Additional Information

A rapid review of the effectiveness and cost effectiveness of interventions that make homes warmer and cheaper to heat for households in fuel poverty in rural and remote areas

Report number: HCRWEC_ RR0002 (April, 2023)

ADDITIONAL INFORMATION (See Rapid Review section 6.2)

Table of Contents

1. Full search strategies

EMBASE (Ovid): 09.01.2023

Search	Query	Results
1	(fuel poverty or fuel poor or fuel vulnerabilit* or energy poverty or energy poor or energy vulnerabilit* or energy-related).tw.	1,983
2	((efficiency measure* or retrofit* or retro-fit* or insulation or energy cafe* or intervention* or initiative* or program* or project* or polic* or strateg* or advice or advisor or support or service* or scheme* or co-operative*) adj10 (home* or house* or housing or rural* or remote or residential or residence)).tw.	168,886
3	1 AND 2	**64**

Scopus, Web of Science and ASSIA: 09.01.2023

("fuel poverty" OR "fuel poor" OR "fuel vulnerabilit*" OR "energy poverty" OR "energy poor" OR "energy vulnerabilit* OR energy-related) AND ("efficiency measure" OR retrofit* OR retro-fit* OR "retro fit" OR insulation OR "energy cafe*" OR intervention* OR initiative* OR program* OR project* OR polic* OR strateg* OR advice OR advisor OR support OR service* OR scheme* OR co-operative*) NEAR/10 (home* OR house* OR housing OR rural OR remote OR residential OR residence)

Scopus: TITLE-ABS-KEY search (2003 – 2023)

Web Of Science: TOPIC search (2003 – 2023)

ASSIA: Anywhere except Full text (NOFT) search (2003 – 2023)

Database	**Results**
EMBASE	64
Scopus	960
WOS	837
ASSIA	20
TOTAL	**1881**

2. Excluded studies

Research reports not retrieved

1. Anonymous 2004: Tackling fuel poverty
   Reason for exclusion: Unavailable

Research reports excluded on full text screening

1. Abrahamse et al. 2007: The effect of tailored information, goal setting, and tailored feedback on household energy use, energy-related behaviors, and behavioral antecedents
   Reason for exclusion: Not focusing on fuel poverty. Not rural.

2. Avanzini et al. 2022: Energy retrofit as an answer to public health costs of fuel poverty in Lisbon social housing
   Reason for exclusion: Theoretical modelling based research.

3. Berger and Holtl 2019: Thermal insulation of rental residential housing: Do energy poor households benefit? A case study in Krems, Austria.
   Reason for exclusion: Not an evaluation of an intervention.

4. Burholt and Windle 2006: Keeping warm? Self-reported housing and home energy efficiency factors impacting on older people heating homes in North Wales.
   Reason for exclusion: Not an evaluation of an intervention.

5. Cabarello and Della Valle 2021: Tackling energy poverty through behavioral change: A pilot study on social comparison interventions in social housing districts
   Reason for exclusion: Wrong intervention Norm based intervention

6. Carrere et al. 2022: Effectiveness of an Energy-Counseling Intervention in reducing energy poverty: evidence from a quasi-experimental study in a southern European city
   Reason for exclusion: Not rural.

7. Castaño-Rosa et al. 2020: Energy poverty goes south? Understanding the costs of energy poverty with the index of vulnerable homes in Spain.
   Reason for exclusion: Qualitative study.

8. Chawla and Pollitt 2013: Energy-efficiency and environmental policies & income supplements in the UK: evolution and distributional impacts on domestic energy bills.
   Reason for exclusion: Wrong intervention: Effects on environmental policy on energy efficiency.

9. Choi et al. 2022: Do energy subsidies affect the indoor temperature and heating energy consumption in low-income households?
   Reason for exclusion: Not rural.

10. Coyne and Denny 2021: Retrofit effectiveness: Evidence from a nationwide residential energy efficiency programme.
    Reason for exclusion: Not those in fuel poverty – anyone on the national gas network, not rural and theoretical modelling based research.

11. Coyne et al 2018: The effects of home energy efficiency upgrades on social housing tenants: evidence from Ireland.

Reason for exclusion: Not rural

12. Curl and Kearns 2016: Housing improvements, fuel payment difficulties and mental health in deprived communities
    Reason for exclusion: Not rural.

13. Das et al. 2022: A review and analysis of initiatives addressing energy poverty and vulnerability in Ontario, Canada.
    Reason for exclusion: Description of organisational literature specific to the Canadian context and no evaluation component.

14. Elsharkawy et al 2018: Energy-efficient retrofit of social housing in the UK: Lessons learned from a Community Energy Saving Programme (CESP) in Nottingham
    Reason for exclusion: Not an evaluation of an intervention, although some cost comparisons reported.

15. Fenwick et al. 2013: Economic analysis of the health impacts of housing improvement studies: a systematic review.
    Reason for exclusion: Wrong outcomes – health impacts.

16. Howden-Chapman et al. 2012: Tackling cold housing and fuel poverty in New Zealand: A review of policies, research, and health impacts.
    Reason for exclusion: Description of literature specific to the New Zealand context and no evaluation component.

17. Ilralde et al. 2021: Energy retrofit of residential building clusters. A literature review of crossover recommended measures, policies instruments and allocated funds in Spain.
    Reason for exclusion: Description of organisational literature specific to the Spanish context and no evaluation component.

18. Jenkins 2018: The value of retrofitting carbon-saving measures into fuel poor social housing
    Reason for exclusion: Theoretical modelling based research.

19. Jones et al. 2013: Retrofitting existing housing: how far, how much?
    Reason for exclusion: Not an evaluation of an intervention, although some cost comparisons reported.

20. Jones et al. 2017: Five energy retrofit houses in South Wales
    Reason for exclusion: Theoretical modelling based research.

21. Karásek and Pojar 2018: Programme to reduce energy poverty in the Czech Republic.
    Reason for exclusion: Description of limited selection of organisational literature specific to the Czech and UK context and no evaluation component.

22. Kyprianou et al. 2019: Energy poverty policies and measures in 5 EU countries: A comparative study.
    Reason for exclusion: Description of policies and measures specific to five European countries and no evaluation component.

23. Latimer et al. 2013. Research and development aspects on decentralized electrification options for rural household.

Reason for exclusion: Description of different decentralized electrification options for rural households and no evaluation.

24. Leardini et al. 2015: Energy upgrade to Passive House standard for historic public housing in New Zealand.
    Reason for exclusion: Theoretical modelling based research.

25. Lee and Shepley 2020: Benefits of solar photovoltaic systems for low-income families in social housing of Korea: Renewable energy applications as solutions to energy poverty
    Reasons for exclusion: Not rural

26. Long et al. 2015: The impact of domestic energy efficiency retrofit schemes on householder attitudes and behaviours
    Reasons for exclusion: Not rural

27. Marchand et al. 2015: Delivering energy efficiency and carbon reduction schemes in England: Lessons from Green Deal Pioneer Places
    Reasons for exclusion: Not rural and wrong outcomes

28. Martiskainen et al. 2018: Community energy initiatives to alleviate fuel poverty: the material politics of Energy Cafés
    Reasons for exclusion: Qualitative study exploring the material politics of Energy Cafés

29. Moses 2013: Poor energy poor: Energy saving obligations, distributional effects, and the malfunction of the priority group.
    Reason for exclusion: Description of approaches to reduce energy poverty and no evaluation.

30. Ortiz et al. 2019. Health and related economic effects of residential energy retrofitting in Spain
    Reason for exclusion: Theoretical modelling based research.

31. Ortiz et al. 2021: tackling energy poverty through collective advisory assemblies and electricity and comfort monitoring campaigns
    Reason for exclusion: Not rural

32. Park et al 2019: The effect of an energy refurbishment scheme on adequate warmth in low-income dwellings.
    Reason for exclusion: Not rural

33. Patterson 2016: Evaluation of a regional retrofit programme to upgrade existing housing stock to reduce carbon emissions, fuel poverty and support the local supply chain.
    Reason for exclusion: No outcomes of interest

34. Perenyi et al 2019: Exploring the Effectiveness of an Energy Efficiency Behaviour Change Project on Well-Being Outcomes for Indigenous Households in Australia
    Reason for exclusion: No outcomes of interest

35. Ramsden et al. 2020: Tackling fuel poverty through household advice and support: exploring the impacts of a charity-led project in a disadvantaged city in the United Kingdom

Reason for exclusion: Not rural

36. Rau et al. 2020: Changing energy cultures? Household energy use before and after a building energy efficiency retrofit.
    Wrong participants – any household and not those in fuel poverty.

37. Reeves 2016: Exploring Local and Community Capacity to Reduce Fuel Poverty: The Case of Home Energy Advice Visits in the UK
    Reason for exclusion: Qualitative study exploring the delivery of home energy advice, plus case studies with document review

38. Reid 2014: 'Deal or no deal?': Assessing the UK's new green deal
    Reason for exclusion: Description of the Green deal and no evaluation

39. Roberts 2020: Warming with wood: Exploring the everyday heating practices of rural off-gas households in Wales.
    Reason for exclusion: Qualitative study to understand the ways in which households in a rural county consume energy.

40. Rugkasa et al. 2007: The right tool for the task: 'boundary spanners' in a partnership approach to tackle fuel poverty in rural Northern Ireland.
    Reason for exclusion: Qualitative study.

41. Scarpellini et al. 2017: The mediating role of social workers in the implementation of regional policies targeting energy poverty.
    Reason for exclusion: Wrong outcomes: The opinion of the social workers about the energy poverty at regional level.

42. Schleich 2019: Energy efficient technology adoption in low-income households in the European Union – What is the evidence?
    Reason for exclusion: Not an evaluation of an intervention.

43. Scott et al. 2016: Evaluating the impact of energy interventions: home audits vs. community events.
    Reason for exclusion: Wrong participants – any household and not those in fuel poverty.

44. Shin et al. 2022: Experimental analysis of low-cost energy retrofit strategies for residential buildings to overcome energy poverty.
    Reason for exclusion: Theoretical modelling based research.

45. Sovacool 2015: Fuel poverty, affordability, and energy justice in England: Policy insights from the Warm Front Program
    Reason for exclusion: Not an evaluation of an intervention.

46. Streimikiene et al. 2020: Climate change mitigation policies targeting households and addressing energy poverty in European Union
    Reason for exclusion: A description of the benefits of climate change mitigation policies and no evaluation.

47. Suárez and Fernández-Agüera 2015: Passive energy strategies in the retrofitting of the residential sector: A practical case study in dry hot climate.
    Reason for exclusion: Theoretical modelling based research.

48. Tonn et al 2021: Health and financial benefits of weatherizing low-income homes in the southeastern United States
    Reason for exclusion: Not rural

49. Trotta 2020: Assessing energy efficiency improvements and related energy security and climate benefits in Finland: An ex post multi-sectoral decomposition analysis
    Reason for exclusion: Wrong participants – not household energy efficiency or an evaluation of an intervention.

50. Vilches et al. 2017: Retrofitting of homes for people in fuel poverty: Approach based on household thermal comfort.
    Reason for exclusion: Theoretical modelling based research.

51. Walker et al. 2014: Fuel poverty in Northern Ireland: Humanizing the plight of vulnerable households.
    Reason for exclusion: Theoretical modelling based research.

52. Walker et al. 2013: Evaluating fuel poverty policy in Northern Ireland using a geographic approach.
    Reason for exclusion: Theoretical modelling based research.

53. Webber et al. 2015: The impacts of household retrofit and domestic energy efficiency schemes: A large scale, ex post evaluation.
    Reason for exclusion: Theoretical modelling based research.

54. Weber and Wolff 2018: Energy efficiency retrofits in the residential sector – analysing tenants' cost burden in a German field study.
    Reason for exclusion: Theoretical modelling based research.

55. Yang et al 2022: Experimental-based energy performance evaluation of low-cost retrofit strategy for aging low-rise residential building for carbon neutrality
    Reason for exclusion: Not rural

Excluded grey literature reports

1. Energy Saving Trust (2022). Home energy programmes delivered by the Energy Saving Trust on behalf of the Scottish Government. January 2022. https://energysavingtrust.org.uk/report/home-energy-programmes-delivered-by-energy-saving-trust-in-scotland-2021/

   Reason for exclusion: Overview of home energy programmes, home energy advice and financial support for home energy delivery.
   Reference listed screened for relevant evaluations.

2. Welsh Parliament. (2022). Fuel poverty and the Warm Homes Programme. Equality and Social Justice Committee. Available at: https://www.audit.wales/sites/default/files/publications/The%20Welsh%20Governments%20Warm%20Homes%20Programme%20-%20English.pdf.

   Reason for exclusion: Not an evaluation of an intervention

3. Maiden, T. Baker, K. and Faulk, A. (2016). Taking the temperature: a review of energy efficiency and fuel poverty schemes in Scotland. Consumer Futures Unit Publication Series 2016: 2. Citizens Advice Scotland. https://www.cas.org.uk/system/files/publications/taking_the_temperature_-_a_review_of_energy_efficiency_and_fuel_poverty_schemes_in_scotland.pdf

   Reason for exclusion: A literature review examines existing evidence on the impacts expected to result from undertaking large scale energy efficiency interventions. Reference listed screened for relevant evaluations.

4. Arnot, J. NHS Scotland (2016). Fuel poverty: overview. Scottish Public Health Network. www.scotphn.net/wp-content/uploads/2016/11/2016_11_10-Fuel-Poverty-JA-Lit-review.pdf

   Reason for exclusion: A literature review of fuel poverty and an overview of schemes in Scotland and examples of schemes in England.
   Reference listed screened for relevant evaluations.

5. Javornik, N. and Mackie, P. (2022). Fuel poverty: review of evidence on existing inerventions in Scotland. An update of ScotPHN 2016 fuel poverty literature review. https://www.scotphn.net/wp-content/uploads/2022/09/2022_09_28-Fuel-poverty-review-of-evidence-on-existing-interventions-in-Scotland-Final.docx

   Reason for exclusion: An update of the 2016 review conducted by Arnot 2016. Reference listed screened for relevant evaluations.

6. Arbed Am Byth Cymru (2021). Arbed annual report. https://gov.wales/sites/default/files/-publications/2022-10/arbed-annual-report-2020-21.pdf

   Reason for exclusion: More recent report 2022 included

7. Powell, J., Keech, D., Reed, M. and Dwyer, J. (2018). What works in tackling rural poverty. March 2018. Wales Centre for Public Policy. https://www.wcpp.org.uk/wp-content/uploads/2018/07/What-Works-in-Tackling-Rural-Poverty.pdf

   Reason for exclusion: Overall summary of interventions tackling rural poverty
   Reference listed screened for relevant evaluations.

8. Citizens Advice (2017). Frozen out: Extra costs faced by vulnerable consumers in the energy market. https://www.citizensadvice.org.uk/Global/CitizensAdvice/Energy/Frozen out.pdf

   Reason for exclusion: Not an evaluation of an intervention of scheme

9. Bevan Foundation response to the Climate Change, Environment and Rural Affairs Committee inquiry into fuel poverty https://www.bevanfoundation.org/wp-content/uploads/2019/10/Fuel-Poverty-Inquiry-Final.pdf

   Reason for exclusion: Not an evaluation of an intervention of scheme

10. Bevan Foundation (2010). Coping with cold: responses to fuel poverty in Wales https://www.bevanfoundation.org/wp-content/uploads/2011/10/Coping-with-Cold-Final-PDF1.pdf

Reason for exclusion: Literature review, semi-structured interviews with people about experiences with fuel poverty

11. Atterson, B., Restrick, S., Melone, H., Baker, K., Mould, R. Stewart, F. Down to the wire. Research into support and advice services for households in Scotland reliant on electric heating.
https://new.theclaymoreproject.com/uploads/entities/1230/files/Publications/down_to_the_wire_-_technical_report_-_eas_gcu_dr_fraser_stewart.pdf

    Reason for exclusion: Literature review and qualitative research

12. Ipsos Mori (2017) Support needs of those in fuel poverty: research report
https://www.cas.org.uk/system/files/publications/support_needs_of_those_in_fuel_poverty_-_ipsos_mori_report_for_cas.pdf

    Reason for exclusion: living experience of fuel poverty qualitative research

13. Citizen Advice Scotland (2017) Facing fuel poverty: research on face-to-face actions to help consumers in fuel poverty in Scotland
https://www.cas.org.uk/system/files/publications/2017-06-22_facing_fuel_poverty_cfu_insight_report.pdf

    Reason for exclusion: Not an evaluation of an intervention of scheme

14. Bridgeman, T., Thumim , J. and Roberts, S. (2018). Tackling fuel poverty, reducing carbon emissions and keeping household bills down: tensions and synergies Report to the Committee on Fuel Poverty
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/713941/Research_by_CSE_for_CFP_-_Policy_Tensions_and_Synergies_-_Final_Report-.pdf

    Reason for exclusion: Modelling / theoretical valuations

15. Preston, I., White, V., Blacklawas K. Hirsh D. (2014). Fuel and poverty: a rapid evidence assessment for the Joseph Rowntree Foundation
https://www.cse.org.uk/downloads/reports-and-publications/fuel-poverty/Fuel_and_poverty_review_June2014.pdf

    Reason for exclusion: Synthesis of evidence on issues associated with fuel costs and poverty and identify effective solutions needed to address these issues – no evaluations within document

16. Burns, P. and Coxon, J. 2016: Boiler on prescription trial. Closing report
https://www.housinglin.org.uk/_assets/Resources/Housing/Research_evaluation/boiler-on-prescription-closing-report.pdf

    Reason for exclusion: Insufficient information on how the data was collected and analysed and unable to determine geographical urban/rural location

17. O'Brien, M. 2020: Mind the fuel poverty gap. Warm home discount in the Scottish context. Citizens Advice Scotland.
https://www.cas.org.uk/system/files/publications/mind_the_fuel_poverty_gap_06.08.pdf

    Reason for exclusion: Modelling / theoretical valuations

3. Critical appraisal scores

JBI critical appraisal checklist for cohort studies (prospective)

Study	JBI Appraisal items											Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	
Sharpe et al. 2020	Y	Y	Y	N	N	U	U	N	n/a	n/a	Y	4/9

Key: Y: Yes; N: No; U: Unclear; n/a: not applicable

1. Were the two groups similar and recruited from the same population?
2. Were the exposures measured similarly to assign people to both exposed and unexposed groups?
3. Was the exposure measured in a valid and reliable way?
4. Were confounding factors identified?
5. Were strategies to deal with confounding factors stated?
6. Were the groups/participants free of the outcome at the start of the study (or at the moment of exposure)?
7. Were the outcomes measured in a valid and reliable way?
8. Was the follow up time reported and sufficient to be long enough for outcomes to occur?
9. Was follow up complete, and if not, were the reasons to loss to follow up described and explored?
10. Were strategies to address incomplete follow up utilized?
11. Was appropriate statistical analysis used?

JBI critical appraisal checklist for randomised controlled trials

Study	JBI Appraisal items													Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	
Heyman et al. 2011	U	U	N	n/a	n/a	n/a	Y	Y	Y	Y	U	Y	Y	6/10

Key: Y – Yes; N – No; U – Unclear; n/a – not applicable

1. Was true randomization used for assignment of participants to treatment groups?
2. Was allocation to treatment groups concealed?
3. Were treatment groups similar at the baseline?
4. Were participants blind to treatment assignment?
5. Were those delivering treatment blind to treatment assignment?
6. Were outcomes assessors blind to treatment assignment?
7. Were treatment groups treated identically other than the intervention of interest?
8. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analysed?
9. Were participants analysed in the groups to which they were randomized?
10. Were outcomes measured in the same way for treatment groups?
11. Were outcomes measured in a reliable way
12. Was appropriate statistical analysis used?
13. Was the trial design appropriate, and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?

JBI critical appraisal scores for quasi-experimental studies

Study	JBI Appraisal items									Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	
Eadson & Leather 2017	Y	U	U	N	Y	N	Y	Y	U	4
Grey et al. 2017	Y	U	Y	Y	Y	Y	Y	Y	Y	8
Papada et al. 2021	Y	U	U	N	U	U	Y	Y	Y	4
Poortinga et al. 2018	Y	N	Y	Y	Y	Y	Y	Y	Y	8
Shortt & Rugkasa 2007	Y	N	U	Y	Y	N	N	N	Y	4
Wade et al. 2019	Y	N	U	Y	Y	N	Y	Y	N	5
Willand et al. 2019	Y	Y	U	Y	Y	N	U	Y	N	5

Key: N: No; Y: Yes, U: Unclear, n/a: not applicable

Q1: Is it clear in the study what is the 'cause' and what is the 'effect' (i.e. there is no confusion about which variable comes first)?
Q2: Were the participants included in any comparisons similar?
Q3: Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?
Q4: Was there a control group?
Q5: Were there multiple measurements of the outcome both pre and post the intervention/exposure?
Q6: Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?
Q7: Were the outcomes of participants included in any comparisons measured in the same way?
Q8: Were outcomes measured in a reliable way?
Q9: Was appropriate statistical analysis used?

JBI critical appraisal scores for case reports

Study	JBI Appraisal items								Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
McGinley et al. 2022	Y	Y	N	Y	Y	Y	Y	Y	7

Key: N: No; Y: Yes, U: Unclear, n/a: not applicable

Q1: Were patient's demographic characteristics clearly described?
Q2: Was the patient's history clearly described and presented as a timeline?
Q3: Was the current clinical condition of the patient on presentation clearly described?
Q4: Were diagnostic tests or assessment methods and the results clearly described?
Q5: Was the intervention(s) or treatment procedure(s) clearly described?
Q6: Was the post-intervention clinical condition clearly described?
Q7: Were adverse events (harms) or unanticipated events identified and described?
Q8: Does the case report provide takeaway lessons?

JBI critical appraisal scores for analytical cross sectional studies

Study	JBI Appraisal items								Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	
Miller et al. 2022	Y	Y	Y	Y	U	U	N	Y	5
Sherriff et al. 2020	Y	N	Y	Y	N	N	Y	Y	5
Welsh Government 2015	Y	Y	Y	Y	N	U	N	Y	5

Key: N: No; Y: Yes, U: Unclear, n/a: not applicable

Q1: Were the criteria for inclusion in the sample clearly defined ?
Q2: Were the study subjects and the setting described in detail?
Q3: Was the exposure measured in a valid and reliable way?
Q4: Were objective, standard criteria used for measurement of the condition?
Q5: Were confounding factors identified?
Q6: Were strategies to deal with confounding factors stated?
Q7: Were the outcomes measured in a valid and reliable way?
Q8: Was appropriate statistical analysis used?

JBI critical appraisal scores for case control studies

Study	JBI Appraisal items										Score
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	
Charlier et al. 2019	U	Y	Y	N	U	Y	Y	Y	U	U	5

Key: N: No; Y: Yes, U: Unclear, n/a: not applicable

Q1: Were the groups comparable other than the presence of disease in cases or the absence of disease in controls?
Q2: Were cases and controls matched appropriately?
Q3: Were the same criteria used for identification of cases and controls?
Q4: Was exposure measured in a standard, valid and reliable way?
Q5: Was exposure measured in the same way for cases and controls?
Q6: Were confounding factors identified?
Q7: Were strategies to deal with confounding factors stated ?
Q8: Were outcomes assessed in a standard, valid and reliable way for cases and controls?
Q9: Was the exposure period of interest long enough to be meaningful?
Q10: Was appropriate statistical analysis used?

4. GRADE evidence profiles

Table of evaluation of confidence using GRADE for randomised controlled trials and observational studies

Citation	Limitations	Imprecision	Indirectness	Inconsistency	Quality
Randomised controlled trials					
Heyman et al. 2011 SAP energy efficiency rating	Serious limitations Rate down one level Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectness	Not relevant	Very low
Heyman et al. 2011 Difference in living room and external temperature (7am to 10am)	Serious limitations Rate down one level Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed	Very serious imprecision Rate down two levels Small sample size and no CI presented	Serious indirectness Rate down one level	Not relevant	Very low
Heyman et al. 2011 Difference between living room and external temperature (6pm to 11pm)	Serious limitations Rate down one level Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed	Very serious imprecision Rate down two levels Small sample size and no CI presented	Serious indirectness Rate down one level	Not relevant	Very low
Heyman et al. 2011 Difference between bedroom and external temperature (10pm to 9am)	Serious limitations Rate down one level Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed	Very serious imprecision Rate down two levels Small sample size and no CI presented	Serious indirectness Rate down one level	Not relevant	Very low
Heyman et al. 2011 Fuel expenditure	Serious limitations Rate down one level Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectness	Not relevant	Very low
Heyman et al. 2011 Satisfaction with home warmth (8-item scale)	Serious limitations Rate down one level	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectness	Not relevant	Very low

	Unclear randomisation, allocation concealment, blinding was not applicable, only loss to follow-up is discussed				
Obervational studies					
Grey et al. 2017 Thermal satisfaction (5-point scale)	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	No imprecision Sample size calculated and CI presented	No serious indirectedness	Not relevant	Very low
Grey et al. 2017 Fuel poverty	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	No imprecision Sample size calculated and CI presented	Serious indirectness Rate down one level	Not relevant	Very low
Grey et al. 2017 Financial difficulties	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	No imprecision Sample size calculated and CI presented	No serious indirectedness	Not relevant	Very low
Grey et al. 2017 Financial stress	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Sample size calculated But no CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Overall indoor air temperature	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Small sample size, but CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Daily average living room temperature	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Small sample size, but CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Daily average bedroom temperature	Serious limitations Rate down one level	Serious imprecision Rate down one level	No serious indirectedness	Not relevant	Very low

	Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Small sample size, but CI presented			
Poortinga et al. 2017 Daily average kitchen temperature	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Small sample size, but CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Length of substandard internal conditions	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Small sample size, but CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Cumulative substandard conditions	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Serious imprecision Rate down one level Small sample size, but CI presented	No serious indirectedness	Not relevant	Very low
Poortinga et al. 2017 Average daily gas use	Serious limitations Rate down one level Quasi-experimental, no randomisation, no allocation concealment, no blinding, loss to follow-up considered	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Willand et al. 2019 Energy efficiency (star ratings)	Very serious limitations Rate down two levels Quasi-experimental, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Willand et al. 2019 Indoor temperatures	Very serious limitations Rate down two levels Quasi-experimental, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Willand et al. 2019 Electricity consumption	Very serious limitations Rate down two levels Quasi-experimental, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low

Willand et al. 2019 Gas consumption	Very serious limitations Rate down two levels Quasi-experimental, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Papada et al. 2021 Plan to apply energy efficiency measures	Very serious limitations Rate down two levels Pre-test / post test no control group, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Papada et al. 2021 Thermal comfort	Very serious limitations Rate down two levels Pre-test / post test no control group, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Papada et al. 2021 Energy savings/ costs	Very serious limitations Rate down two levels Pre-test / post test no control group, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Shortt & Rugraska 2007 Fuel cost	Very serious limitations Rate down two levels Pre-test / post-test, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Shortt & Rugraska 2007 Temperature	Very serious limitations Rate down two levels Pre-test / post-test, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low
Sharpe et al. 2020 Ability to pay bills	Very serious limitations Rate down two levels Post-test with control group, no randomisation, no allocation concealment,	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low

	no blinding, no consideration for loss to follow-up				
Sharpe et al. 2020 Avoid heating	Very serious limitations Rate down two levels Post-test with control group, no randomisation, no allocation concealment, no blinding, no consideration for loss to follow-up	Very serious imprecision Rate down two levels Small sample size and no CI presented	No serious indirectedness	Not relevant	Very low