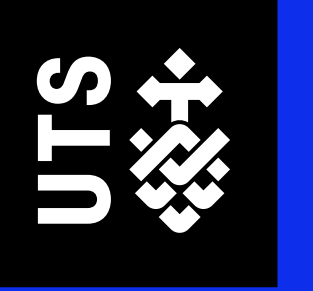


# Evaluation of Victorian Healthy Homes Program



Presenter: Lutfun Hossain

Authors: Katie Page<sup>1</sup>, Kees van Gool<sup>1</sup>, Margaret Campbell<sup>1</sup>, Thomas Longden<sup>1,4</sup>, Patricia Kenny<sup>1</sup>, Lutfun Hossain<sup>1</sup>, Dan Liu<sup>1</sup>, Kerryn Wilmot<sup>2</sup> Scott Kelly<sup>2</sup>, Yo Han Kim<sup>2</sup>, Philip Haywood<sup>1</sup>, Brendan Mulhern<sup>1</sup>, Stephen Goodall<sup>1</sup>, Rosalie Viney<sup>1</sup>, Toby Cumming<sup>3</sup>, Matthew Soeberg<sup>3</sup>

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# Victorian Healthy Homes Program

- Living in poor quality homes affects health
- Ensure safe and healthy dwellings



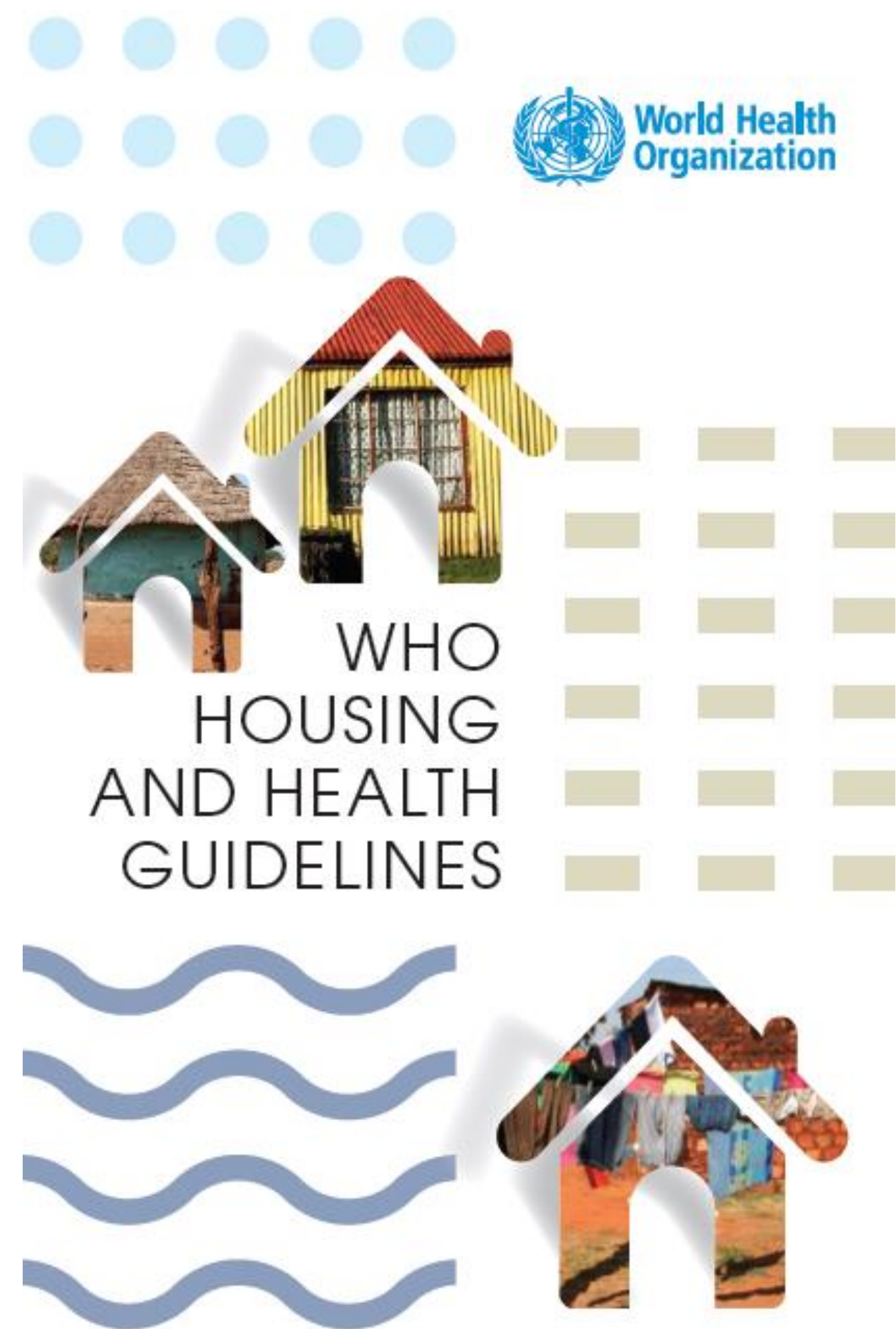
# Victorian Healthy Homes Program - Background

- Cold indoor temperatures
  - Worsen COPD and asthma symptoms
  - Worsen blood pressure
  - Impact mental health
- Cold homes caused by:
  - Cold outdoor temperatures
  - Poor thermal performance of homes
  - Lack of insulation
  - Lack of heating



# Victorian Healthy Homes Program - Background

- Vulnerable people (e.g. elder, disability, chronic illnesses) are often low-income → cant afford heating costs → suffer cold homes
- WHO Housing and Health guidelines - indoor housing temperatures  $> 18^{\circ}\text{C}$



# Victorian Healthy Homes Program - Background

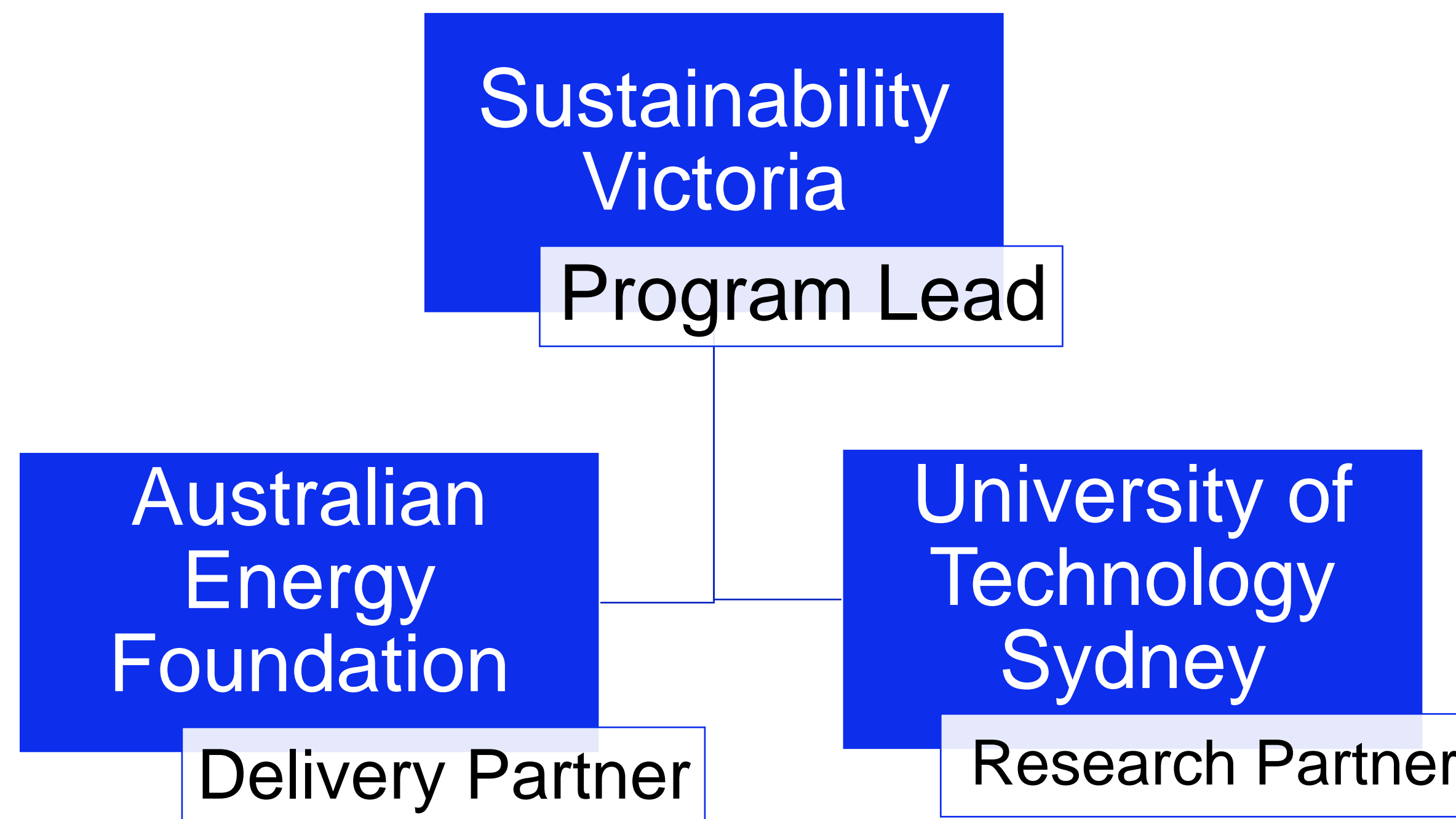
## International research

- Thermal insulation and energy efficient heating upgrades
  - Reduced hospitalisations
  - Decreased wheezing
  - Improved lung function in children with asthma
- More energy efficient housing → ↓ mortality
- Evidence for Australian setting is lacking



# Victorian Healthy Homes Program - Background

- Sustainability Victoria (SV)
- Australian Energy Foundation (AEF)
- University of Technology Sydney (UTS)



# Victorian Healthy Homes Program - Background

- Implemented in 9 LGAs reflecting metropolitan and regional Victoria
- Home thermal comfort and energy efficiency upgrades (~\$3,500) to up to 1,000 households



# Victorian Healthy Homes Program – rationale for the study

- Healthy Homes Program is the first of its kind
  - Implemented alongside an innovative research program
  - Data collected at household & individual levels to understand the link between energy efficiency & warmth upgrades in low income households, with improved health and quality of life
  - Rare to have RCTs in this area of public policy – growing recognition of links between housing, climate and health.

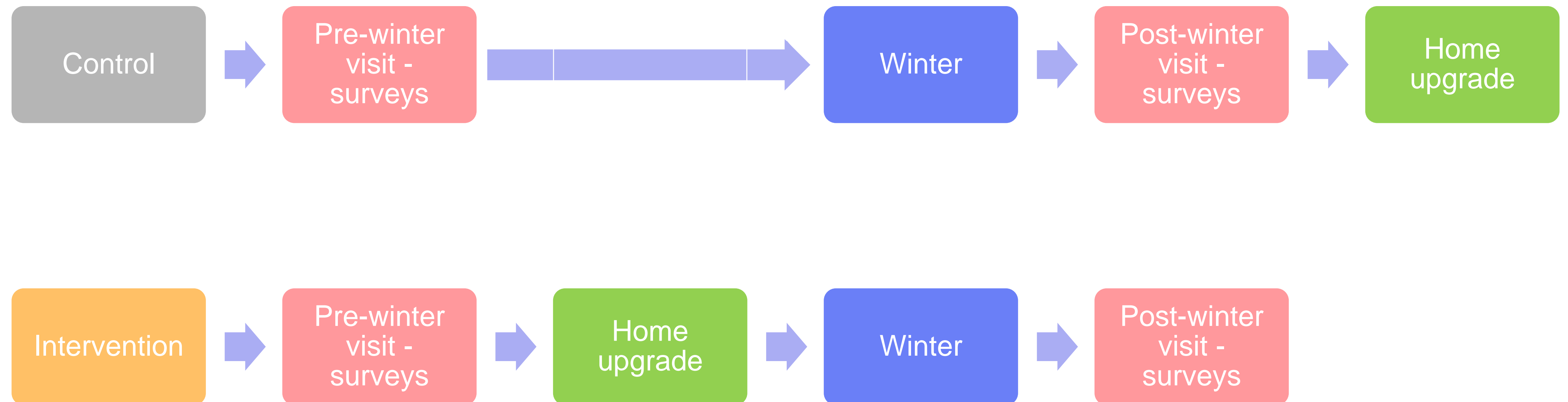


# Victorian Healthy Homes Program - objectives

1. measure the energy benefits of the VHHP;
2. measure the health benefits of the VHHP;
3. measure the costs and outcomes of the VHHP with an economic evaluation of the program.



# Victorian Healthy Homes Program – methods and design



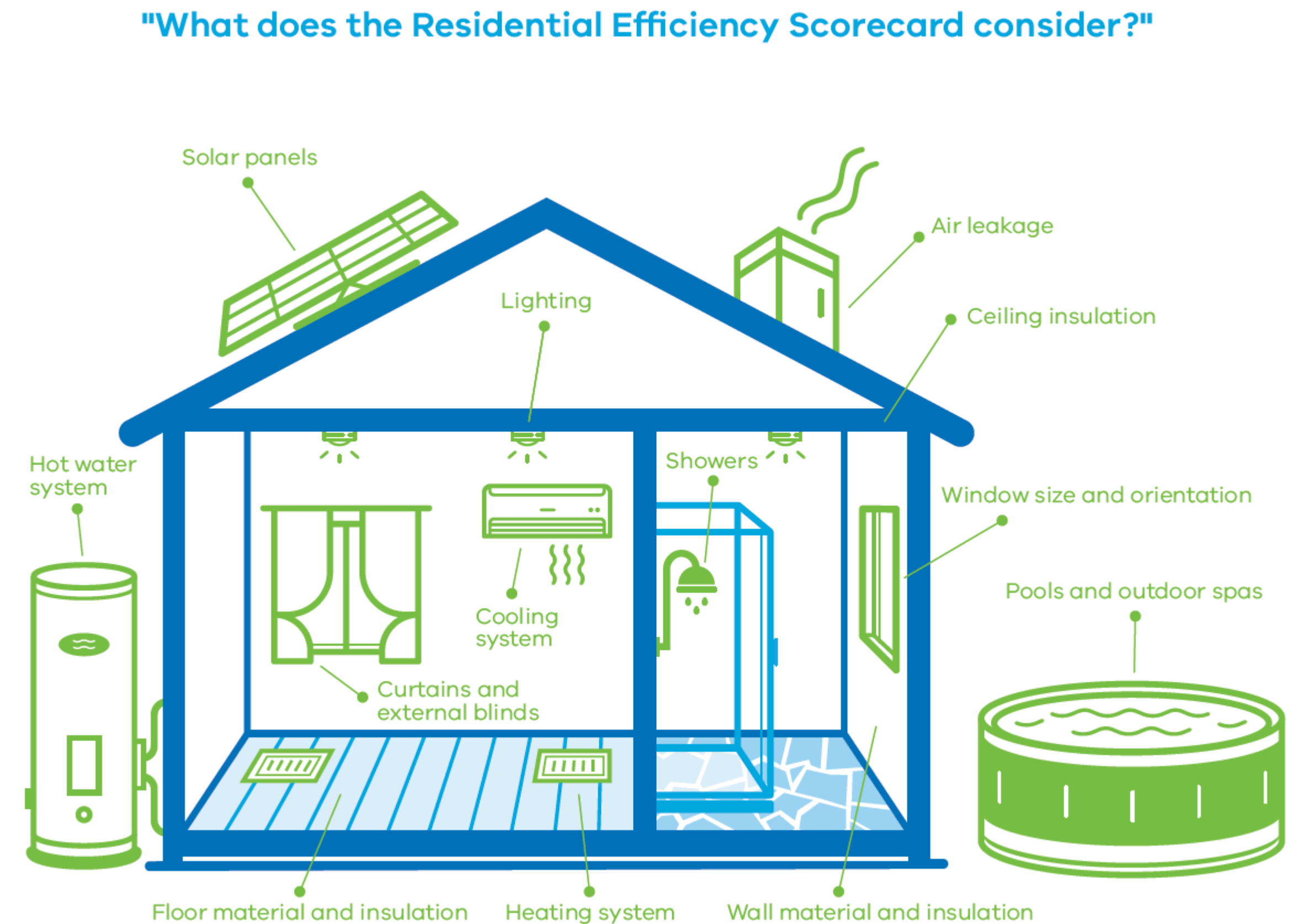
## Victorian Healthy Homes Program – Eligibility criteria

- Aged  $\geq$  18 years
- Low income (1. Commonwealth (Centrelink) Health Care or 2. Pensioner (Centrelink) Concession or 3. Department of Veterans' Affairs (DVA) Pensioner Concession or 4. Department of Veterans' Affairs (DVA) Gold Card)
- Person has need for home care support services or has an existing health condition.
- Living in Melbourne's western suburbs or the Goulburn Valley
- Has lived in the current home for at least 1 year and plans to remain there for another 2 years or more
- Mental capacity to provide consent



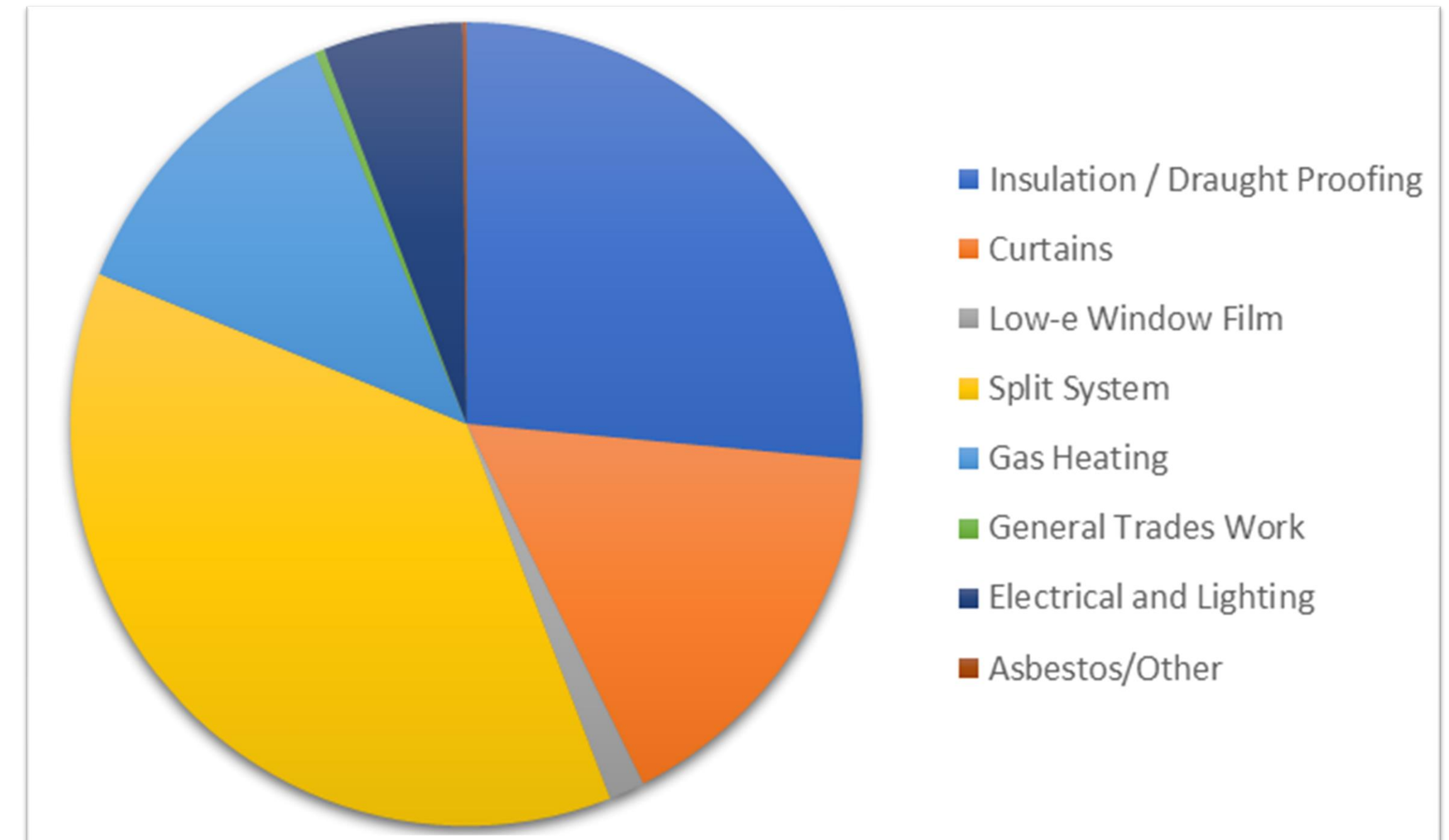
# Victorian Healthy Homes Program – methods and design

- Victorian Residential Efficiency Scorecard (VRES) assess energy costs of home
- RES rating informed the type of upgrade works completed
- Currently, the average home is 3-star rated so there are opportunities to increase a home's rating



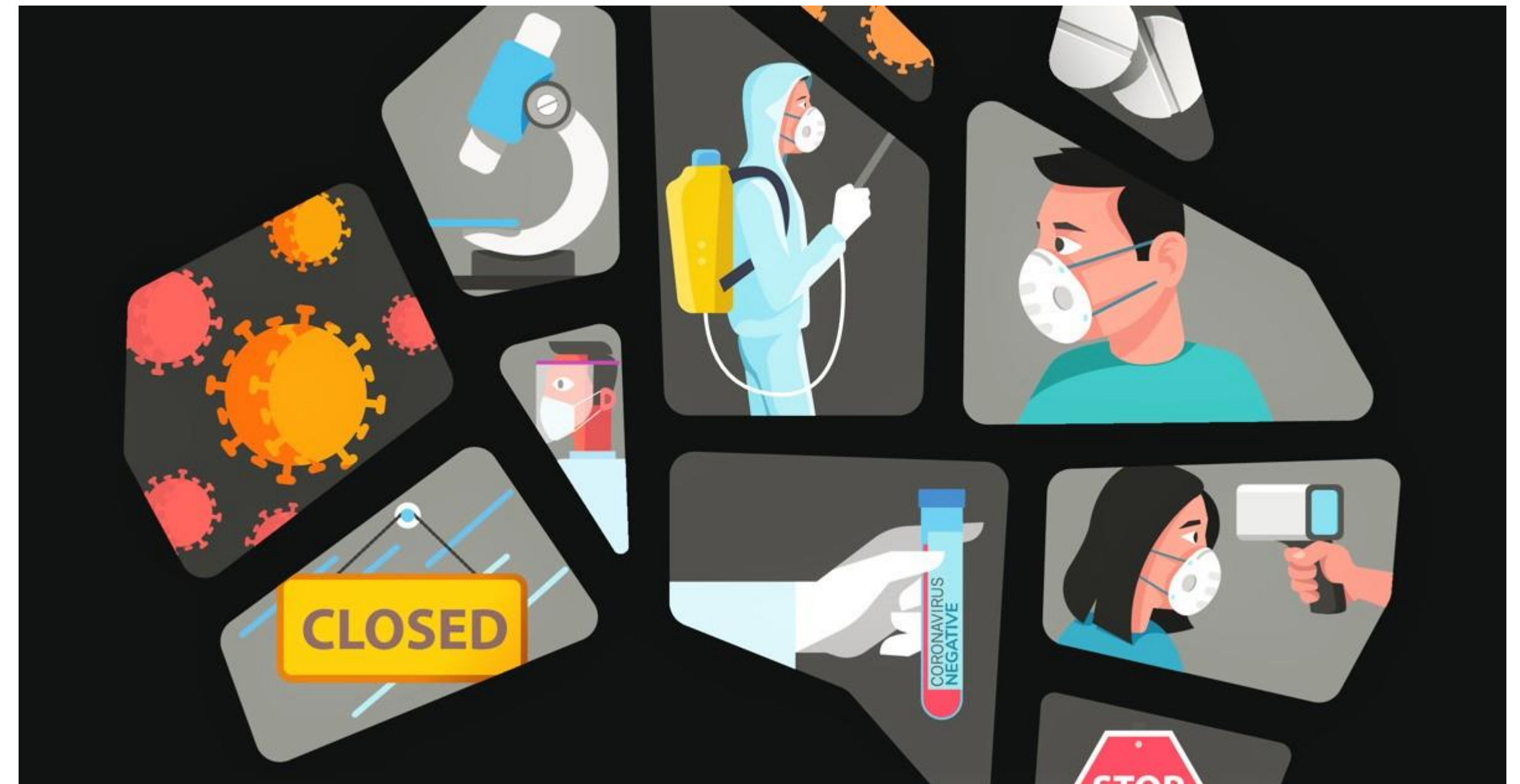
# Victorian Healthy Homes Program – methods and design

- VRES assessment informed the type of upgrade works completed
- Upgrades included:
  - ceiling and underfloor insulation
  - draught sealing external doors
  - reverse cycle air conditioning
  - replacement of gas heater
  - upgrades to lighting
  - internal window coverings.



# Victorian Healthy Homes Program – COVID-19 impacts

- COVID-19 LGA lockdowns in Victoria delayed home visits and home upgrades
- Intervention households received no or partial upgrades



# Victorian Healthy Homes Program – COVID-19 impacts

- Reduced overall sample size and power of the analysis for all outcomes
- Intention-to-treat (ITT) and per-protocol (PP) analysis have been undertaken

	<b>2018</b>	<b>2019</b>	<b>2020</b>	<b>Total</b>
Households recruited	105	268	611	984

	<b>Planned</b>	<b>Reality</b>
Control	493	488
Intervention	491	276
Total	984	764
	ITT	PP

# Victorian Healthy Homes Program – Outcomes

Type of outcome	
Primary outcome (thermal comfort)	<ul style="list-style-type: none"> <li>• Temperature within the home – as mean difference in temperature</li> <li>• Temperature within the home – as the number of days below comfort thresholds</li> </ul>
Secondary outcome (household level)	<ul style="list-style-type: none"> <li>• Humidity within the home (measured by a data logger)</li> <li>• Change in the amount of mould/mildew observed by the household</li> <li>• Change in the amount of damp observed by the household</li> <li>• Energy use by the household</li> </ul>
Secondary outcome (individual level)	<ul style="list-style-type: none"> <li>• Health related quality of life (SF-36, EQ-5D-5L and ASCOT instruments)</li> <li>• Respiratory symptoms</li> <li>• Healthcare utilisation during winter (including hospitalisations, emergency department presentations, primary care visits and pharmaceuticals)</li> <li>• Absenteeism from school/work</li> </ul>

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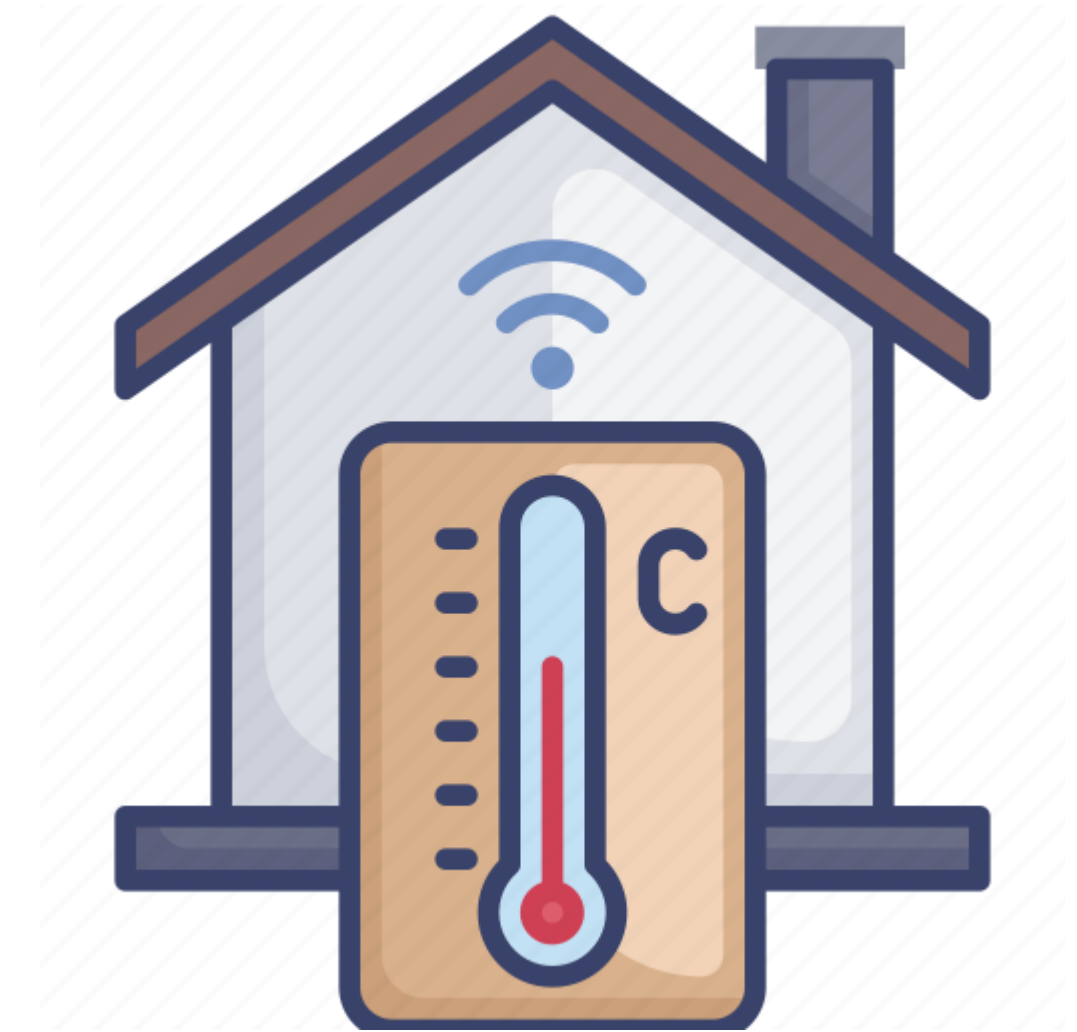
## VHHP– Primary Outcome: Thermal Comfort

- Primary outcome: average difference in temperature in the home between the intervention and control groups over winter
- Winter = 22 June to 21 September
- Data logger measured temperature every 30 minutes
- Primary outcome: percentage of time each household is exposed to cold (below 18°C)



# Victorian Healthy Homes Program – Primary Outcome

- Increase in mean indoor temperature over winter by 0.33°C per day (ITT) and 0.36°C (PP)
- Reduced exposure to cold indoor conditions by 43 minutes/day (ITT) and 56 minutes/day (PP)
- Homes with poorer housing conditions (VRES rating < 5) experience:
  - double the increase in mean indoor temperatures (0.55°C compared to 0.23°C (PP))
  - nearly 3x the reduction in exposure to unhealthy (<18°C) indoor temperatures (89 minutes compared to 34 minutes; PP)
- Average house uses 14kwh/day
  - 1kwh/day = ↑ 0.08°C



# VHHP – Secondary Outcome: Quality of Life

- Three established instruments were used to collect participant's self-reported quality of life and social care:
  - EuroQol 5-dimension and 5-level (EQ-5D-5L)
  - short form-36 (SF-36)
  - Adult Social Care Outcomes Tool (ASCOT) measured changes in self-reported quality of life and social care before and after winter
- Outcomes were analysed over the 3-month winter period
- Overall the intervention had a positive effect on mental health and social care

How good is your health TODAY

The best health you can imagine

100  
 90  
 80  
 70  
 60  
 50  
 40  
 30  
 20  
 10  
 0

- We would like to know how good or bad your health is TODAY.
- This line is numbered from 0 to 100.
- 100 means the best health you can imagine. 0 means the worst health you can imagine.
- Please mark an X on the line that shows how good or bad your health is TODAY.

The worst health you can imagine

# VHHP – Secondary Outcome: Quality of Life

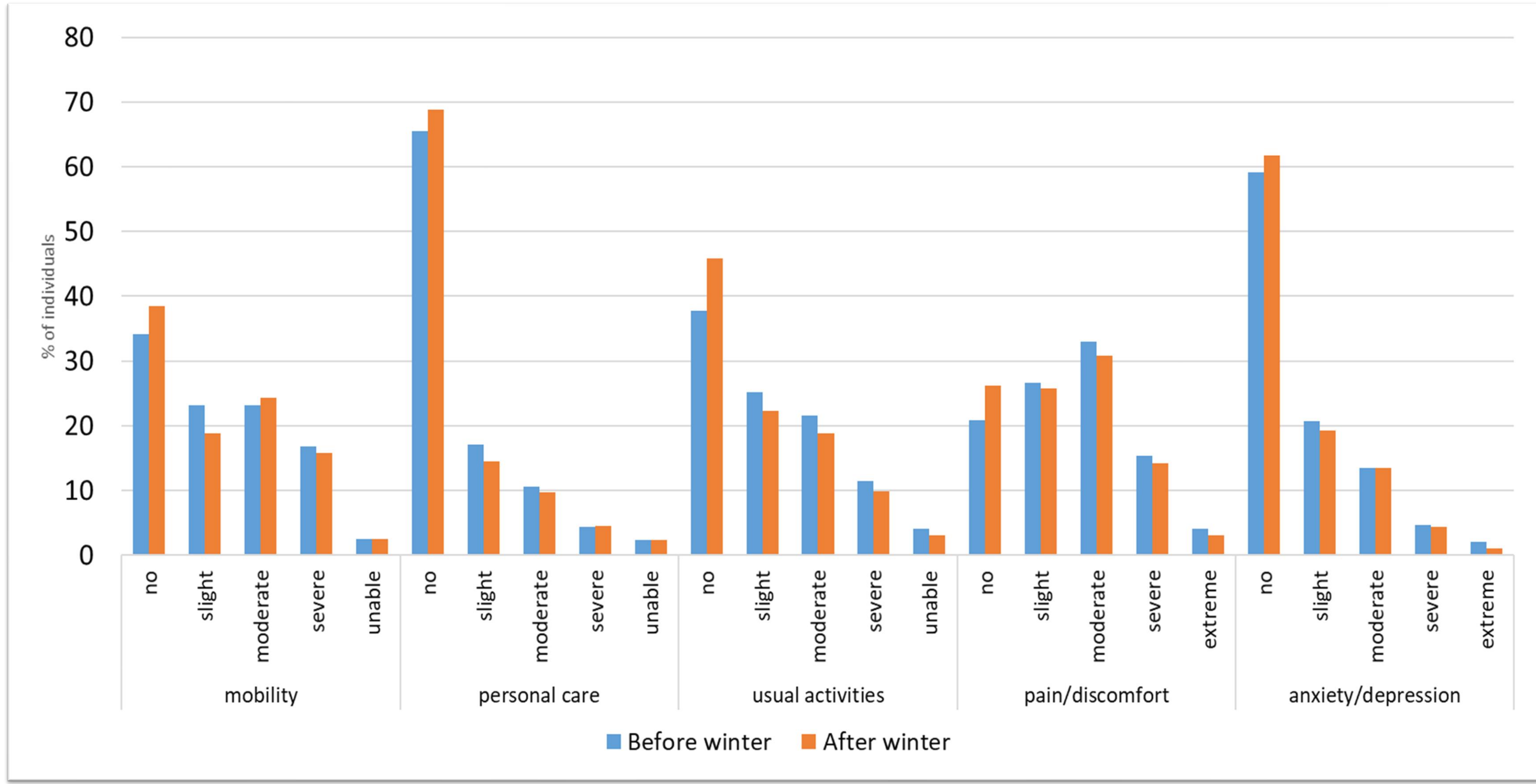
## EQ-5D-5L

5 dimensions:

1. mobility
2. personal care
3. usual activities
4. pain/discomfort
5. anxiety and depression

Five levels:

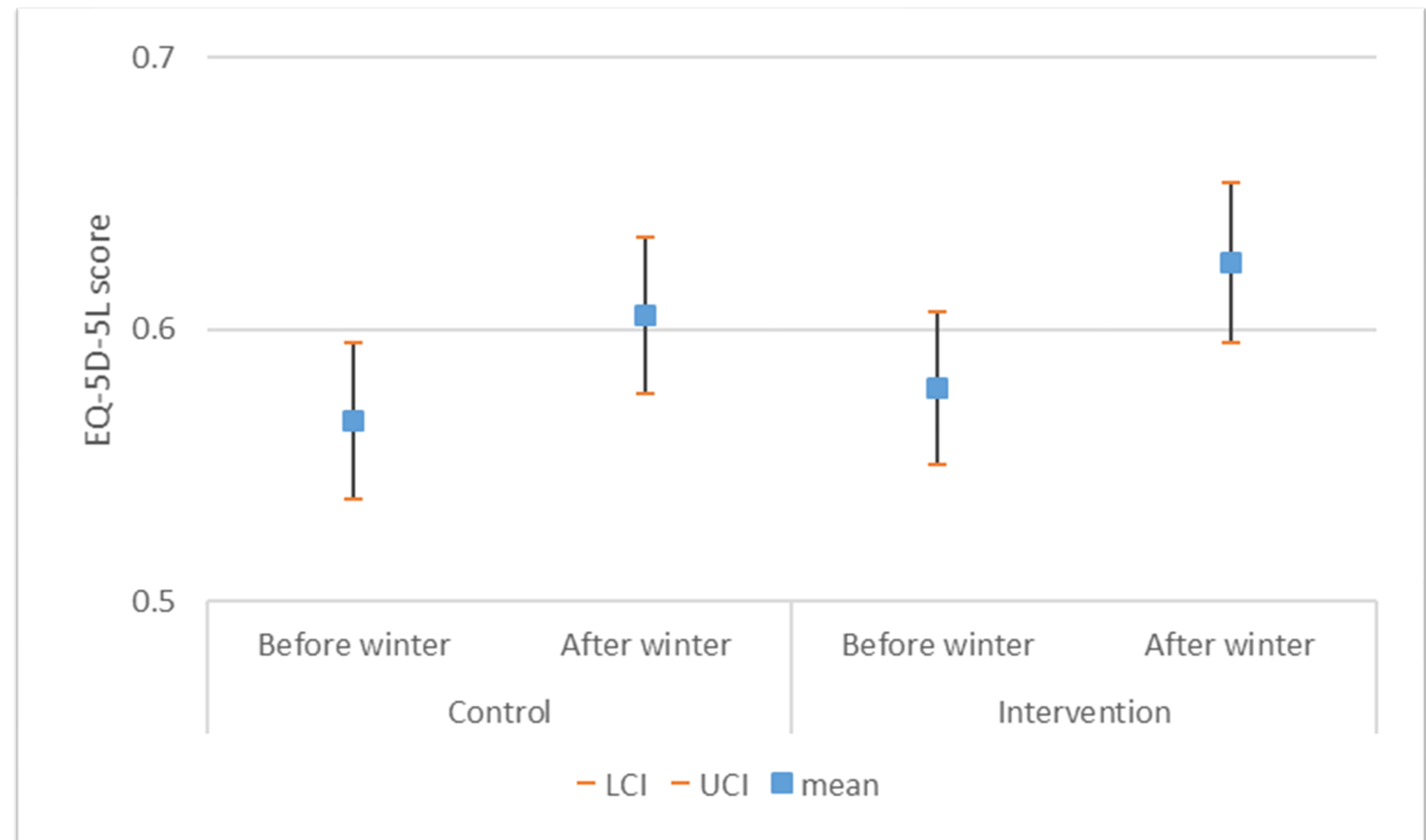
1. no problems
2. slight problems
3. moderate problems
4. severe problems
5. extreme problems



## VHHP – Secondary Outcome: Quality of Life

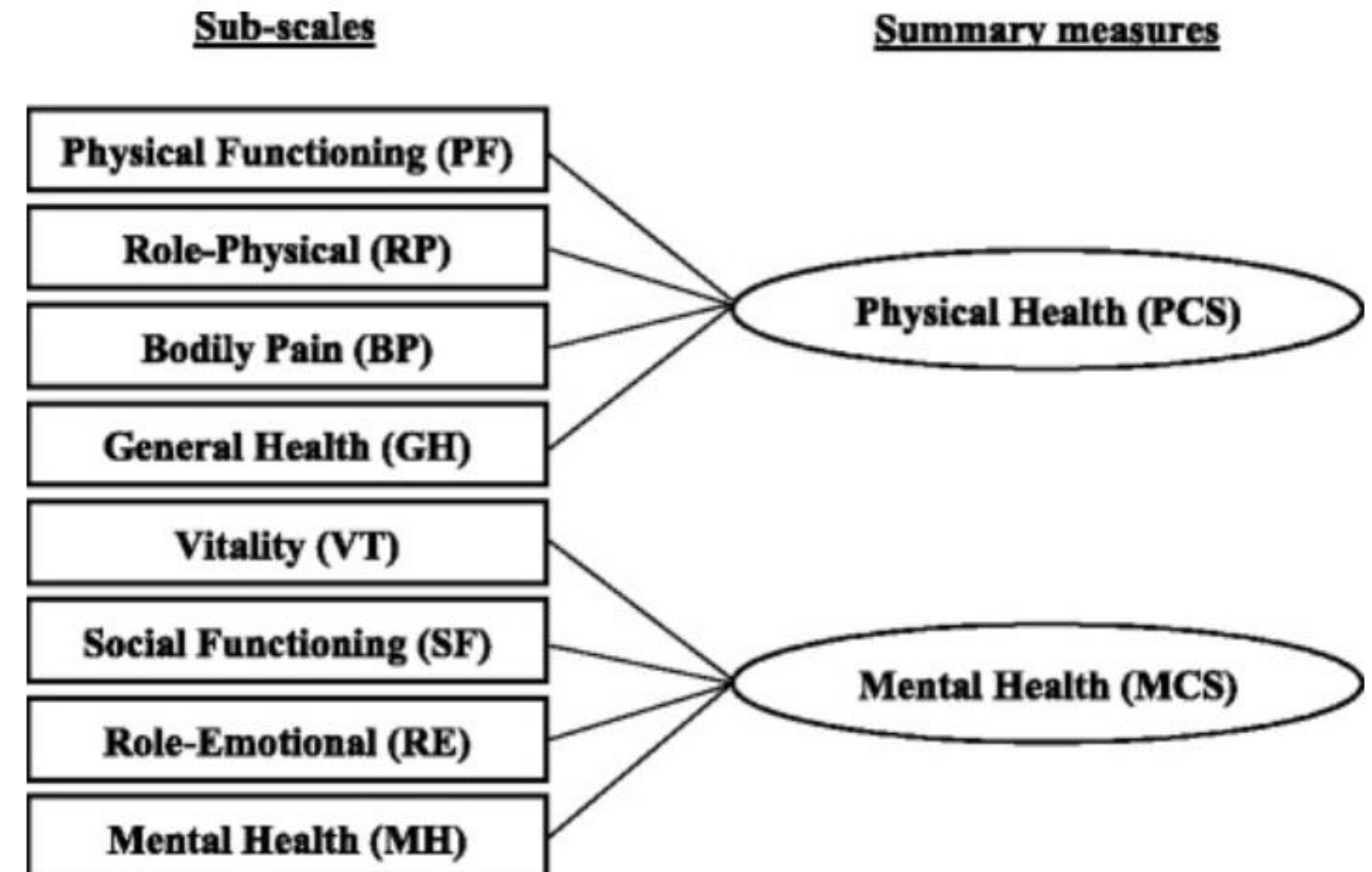
- Mean EQ-5D-5L utility scores increase for both intervention and control groups after winter
- A linear regression showed no significant effect of the intervention on EQ-5D-5L scores
- Australians  $\geq 75$  years average score 0.83
- VHHP sample average score 0.62
- VHHP sample have poorer quality of life than population average

	N	min	max	mean	SD
<b>Control</b>					
Before winter	633	-0.650	1	0.566	0.367
After winter	564	-0.576	1	0.605	0.349
<b>Intervention</b>					
Before winter	637	-0.676	1	0.578	0.361
After winter	550	-0.493	1	0.624	0.352



## VHHP – Secondary Outcome: Quality of Life

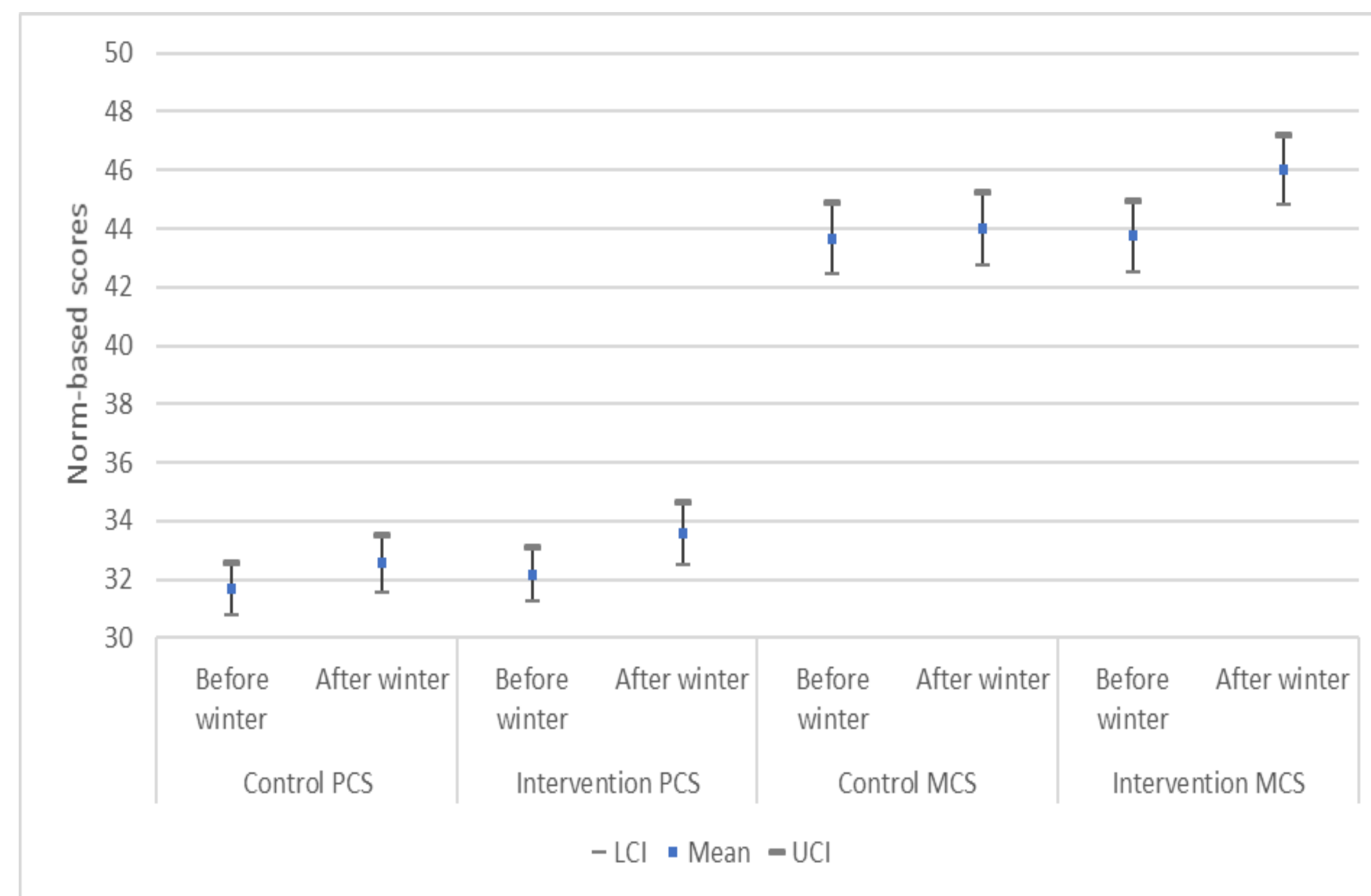
- The SF-36 measures eight aspects of health
- Two summary scores: the physical component summary (PCS) and the mental component summary (MCS)
- Intervention group: improvements in all 8 sub-scales of health
- Control group: small decline in physical functioning and mental health



## VHHP – Secondary Outcome: Quality of Life

- The intervention group saw a significant improvement in the mean MCS score after winter of 2.3 norm-based scores ( $p < 0.05$  ITT) ( $p < 0.10$  PP)
- Changes in the PCS not significant, but increasing age associated with lower PCS score ( $p < 0.05$ )

	MCS				PCS			
	Before winter		After winter		Before winter		After winter	
	Mean Score	SD	Mean score	SD	Mean Score	SD	Mean score	SD
<b>control</b>	44	14.78	44	14.54	32	10.81	33	11.55
<b>intervention</b>	44	15.03	46	13.84	32	11.65	34	12.22



# VHHP – Secondary Outcome: Quality of Life

## Adult Social Care Outcomes Toolkit (ASCOT)

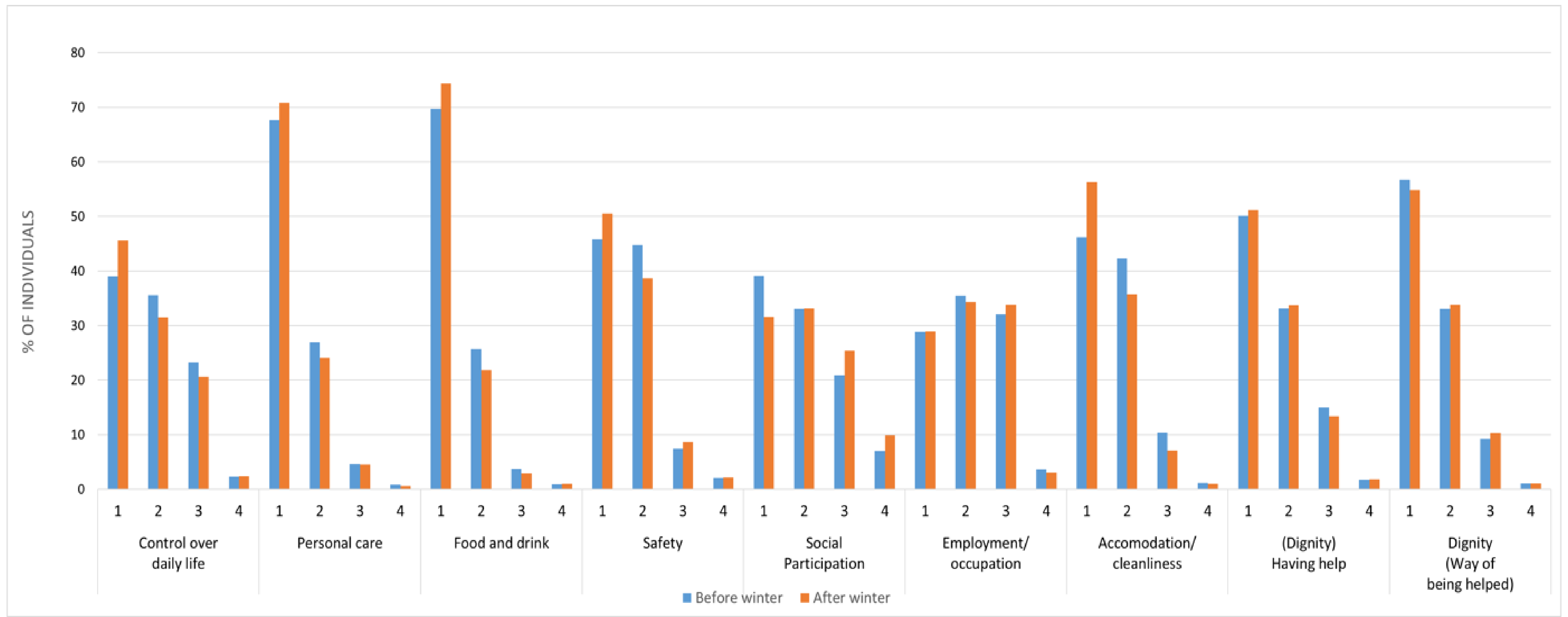
### 9 Dimensions:

1. Control over daily life
2. Personal cleanliness/comfort
3. Food and drink
4. Personal safety
5. Social participation
6. Employment/occupation
7. Accommodation cleanliness/comfort
8. Dignity (having helped)
9. Dignity (way of being helped).

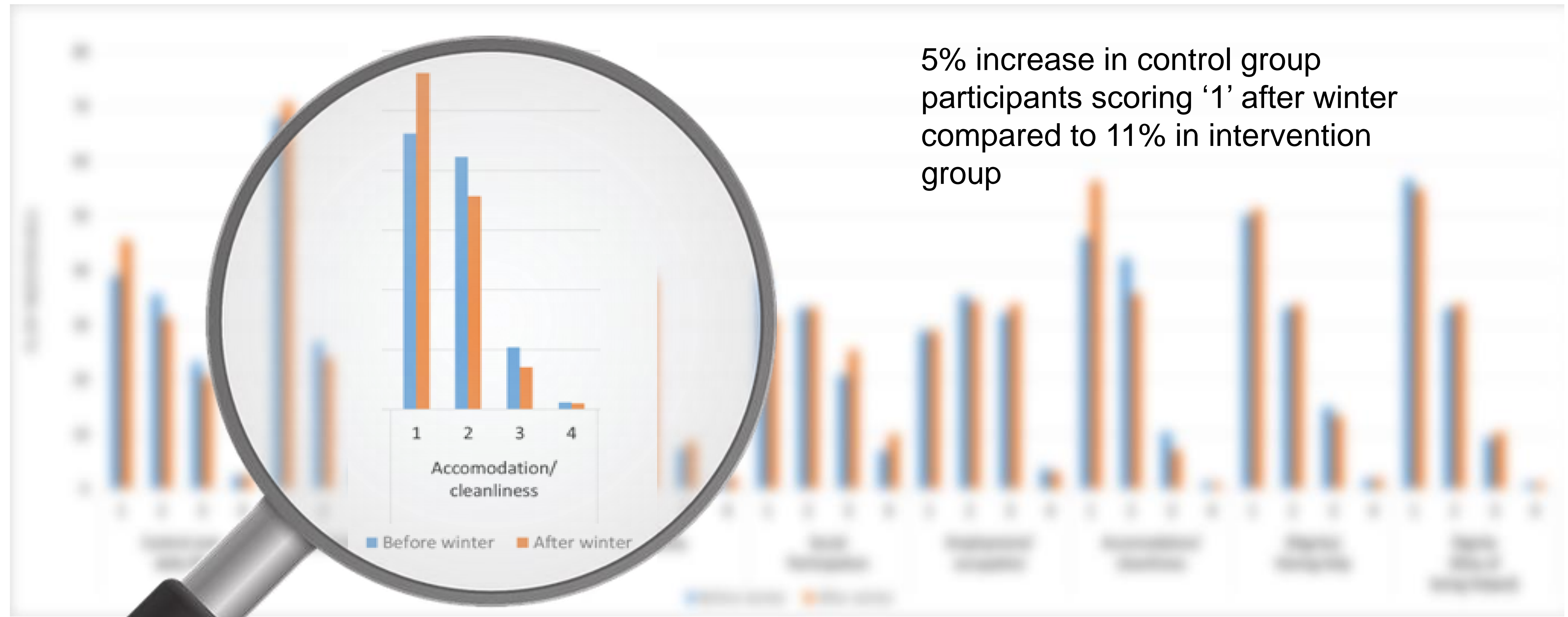
### 4 levels:

1. Ideal - the preferred situation, in which needs are met to the desired level;
2. No needs - where needs are met, but not to the desired level;
3. Low-level needs - where there are needs, but these do not have an immediate or longer-term health implication; and
4. High-level needs - here there are needs and these have an immediate or longer-term health implication.

# VHHP – Secondary Outcome: Quality of Life



# VHHP – Secondary Outcome: Quality of Life

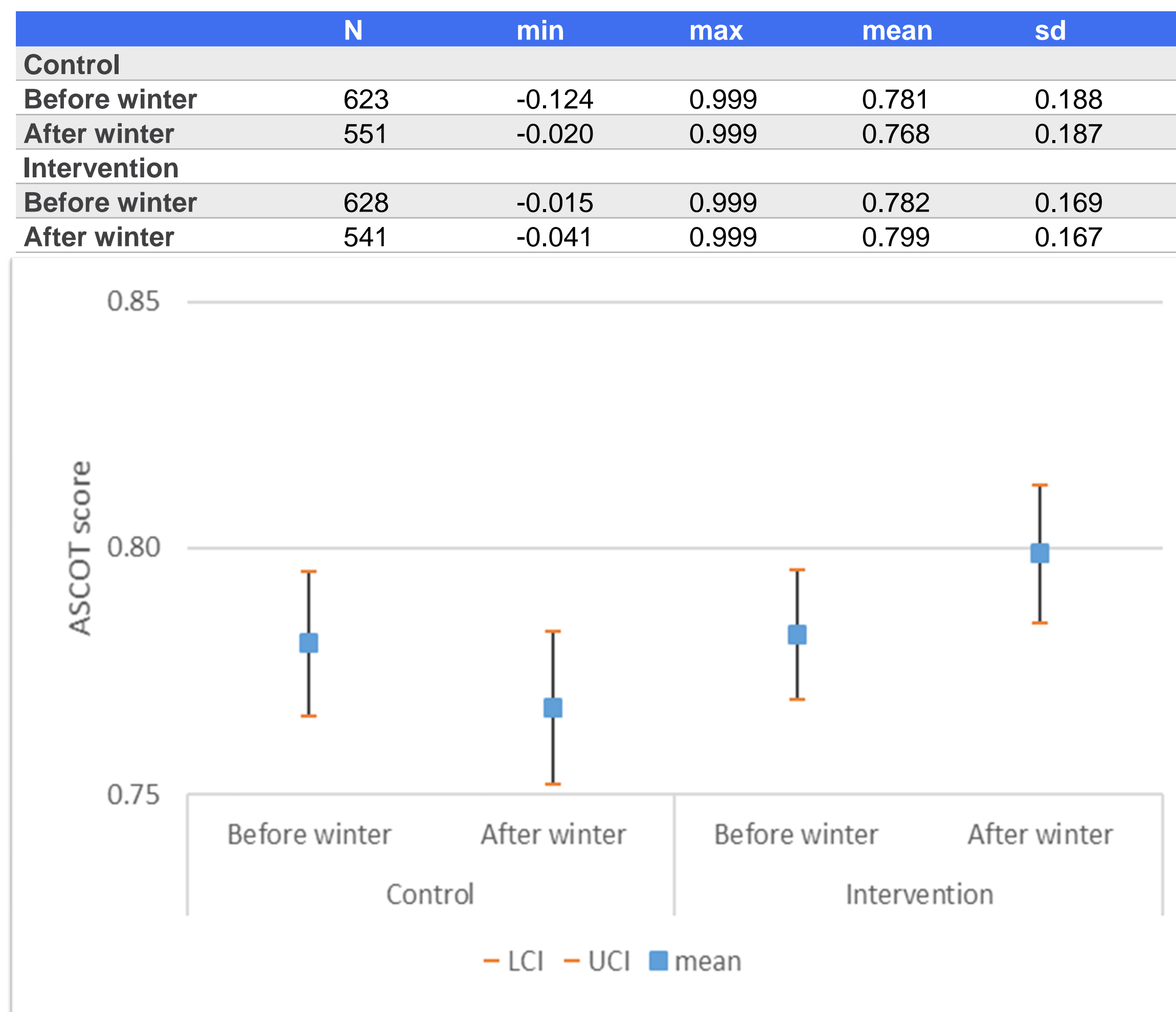


# VHHP – Secondary Outcome: Quality of Life



## VHHP – Secondary Outcome: Quality of Life

The intervention group saw a small but statistically significant improvement in the mean ASCOT score of 0.017 which is significant at the ( $p < 0.05$  ITT)



## VHHP – Secondary Outcome: Quality of Life summary

- VHHP sample on average experiencing poorer quality of life than the general  $\geq 75$  population
- Intervention has had a positive effect on health and social care related quality of life for participants, with the largest impacts being on mental health.

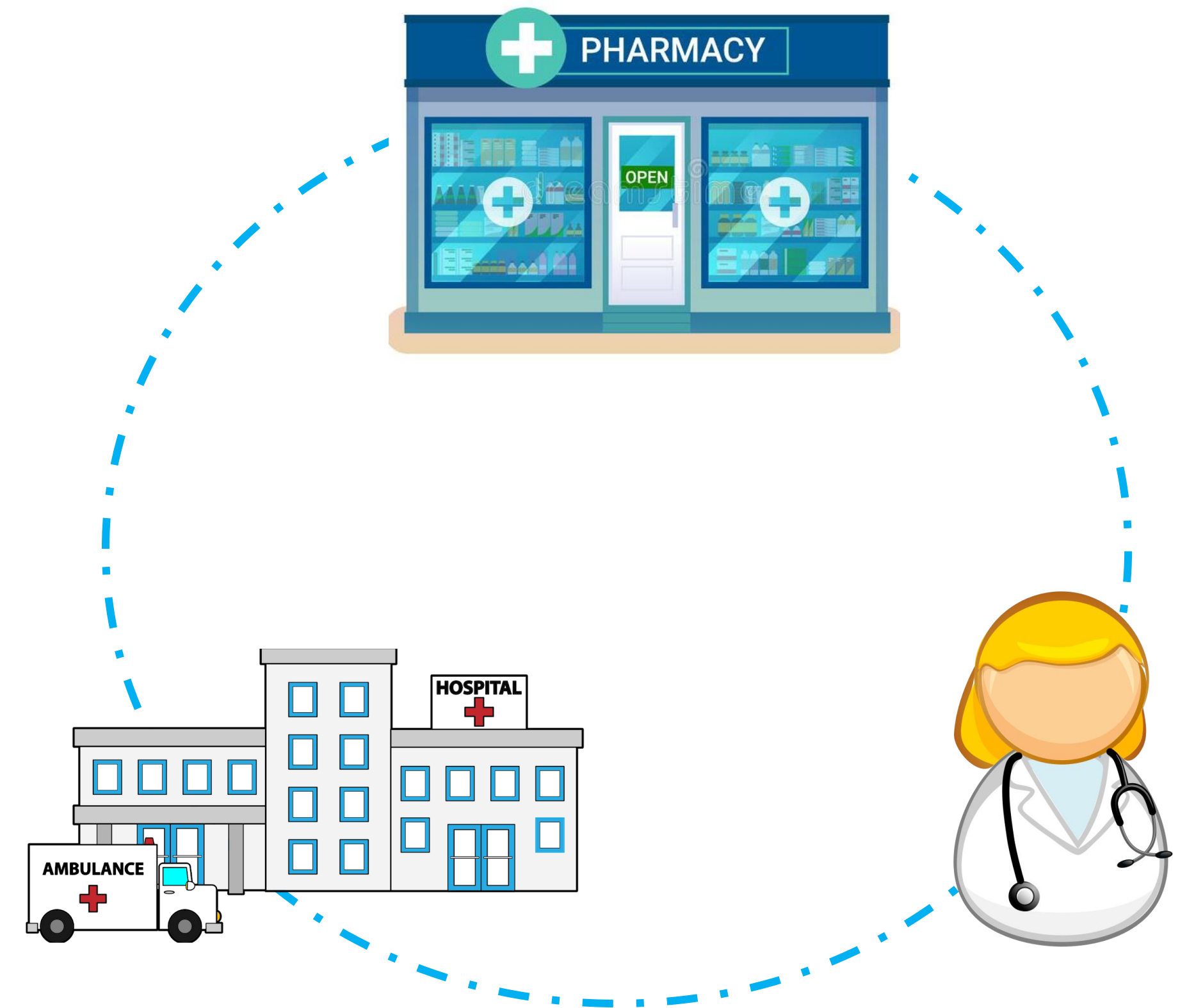


# VHHP – Secondary Outcome: Healthcare utilisation

Data set	Outcome of interest
<b>Medicare Benefits Scheme (MBS)</b>	Number of total claims per person Number of GP claims per person Government and patient costs (charges) per person Overall government costs (benefits paid) per person Overall patient costs (out-of-pocket costs) person
<b>Pharmaceutical Benefits Scheme (PBS)</b>	Number of prescriptions dispensed Government and patient costs (gross price) per person Overall government costs (net benefits paid) per person Overall patient costs (out-of-pocket costs) person
<b>Hospital</b>	Hospital admission (count or dummy variables) over the three-month winter period Total length of hospital stay (days) Costs (\$)
<b>Emergency</b>	Emergency department admission (count or dummy variables) over three-month winter period Costs (\$)
<b>Deaths</b>	Number and rate of deaths

# VHHP – Secondary Outcome: Healthcare utilisation

- Overall, small differences between control and intervention
- Intervention group on average used less MBS services over winter (12.8) compared to control (15.2)
- Average total healthcare costs were lower for the intervention group (\$3394) than the control (\$4172) in the winter period
- Across all MBS outcomes, there is a drop in services in 2020 for both control and intervention (COVID-19 strikes again)
- There were no significant differences in PBS, hospital outcomes but findings in favour of the intervention
- Impact of the intervention has only been assessed over the three winter months.



# Victorian Healthy Homes Program – Cost-effectiveness Analysis

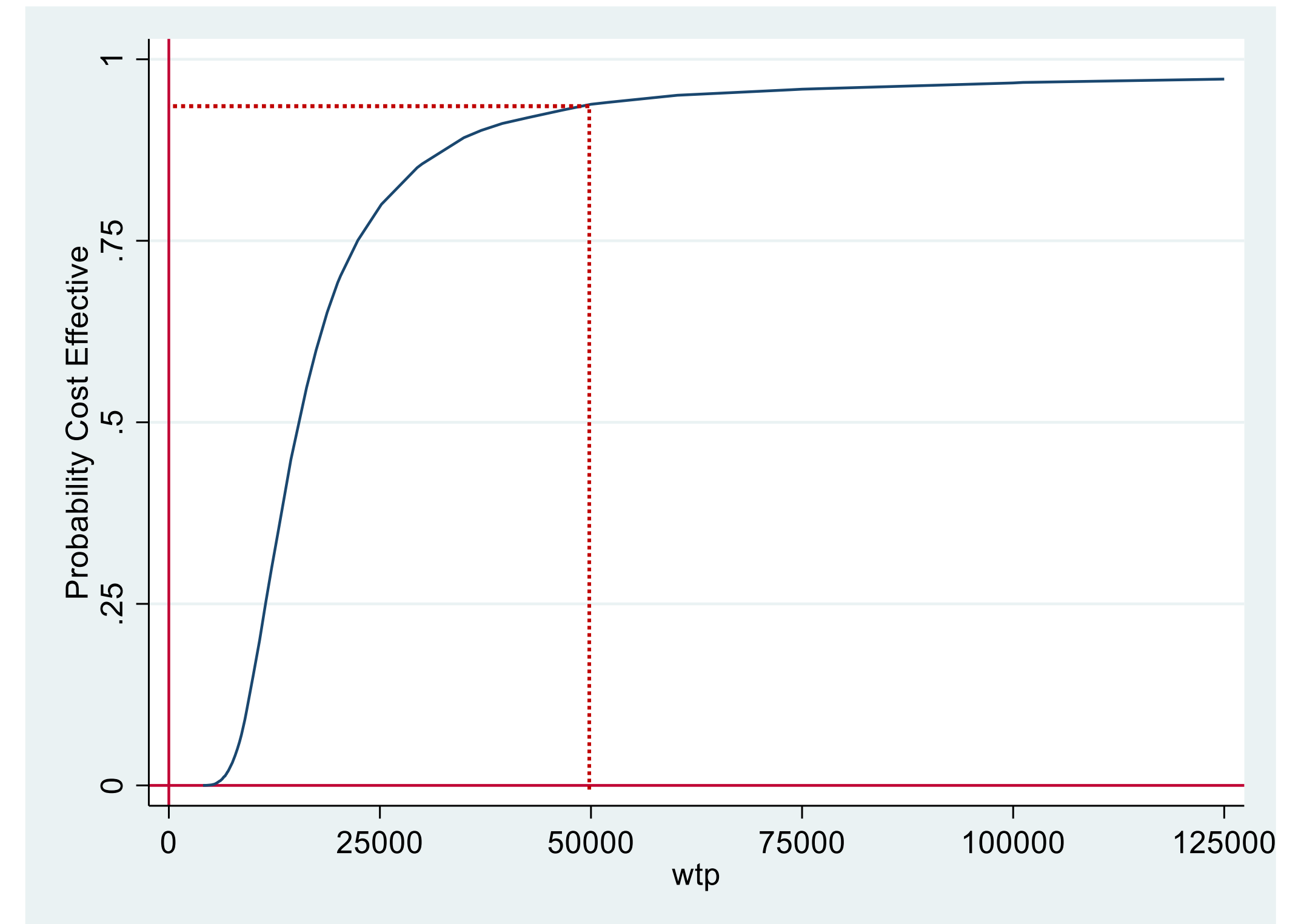
Data set	Outcome of interest
Upgrade cost	\$2809 per household
Administrative cost	\$2686 per household
Total program cost	\$5495 per household
Average cost savings (from health and energy costs)	-\$811.65
Increment cost for an average winter temperature increase of 0.33°C	\$4684 per household (\$4810 modelled from CEA)
Incremental cost-effectiveness ratio (ICER)	

$$ICER = \frac{Cost(A) - Cost(B)}{Benefit(A) - Benefit(B)}$$

ICER is \$15,232 per 1°C increase in mean indoor temperature.

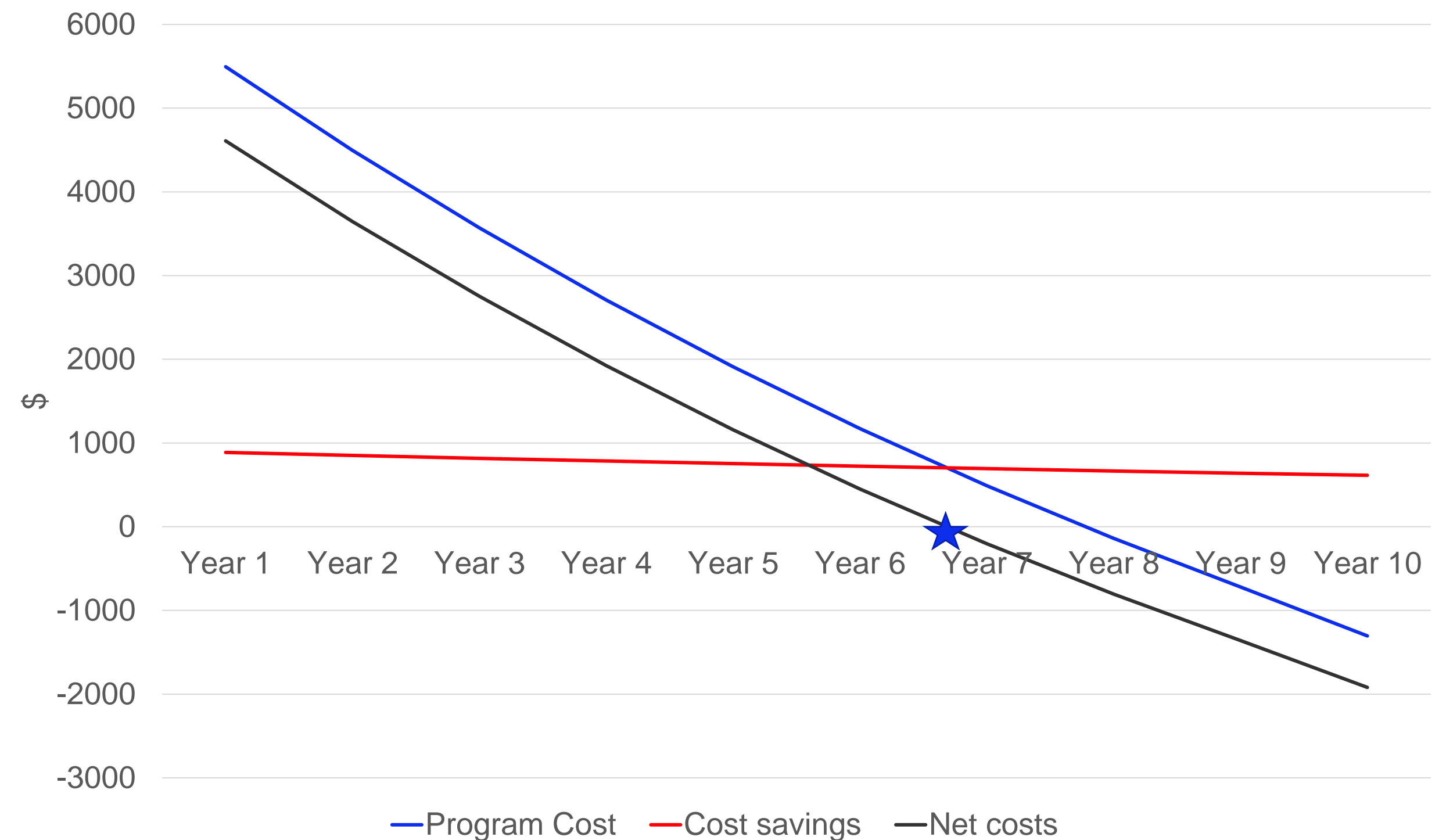
# Victorian Healthy Homes Program – Cost-effectiveness Analysis

- The probability that the VHHP is cost effective at
  - WTP of \$20,000 is 69%
  - WTP of \$28,000 it's \$84%
  - WTP of \$50,000 is 93.8%
- This WTP is for a 1<sup>0</sup>C increase in mean winter indoor temperature per day of winter



# Victorian Healthy Homes Program – Extrapolated cost analysis

- How long does it take for the Victorian Healthy Homes Program to be cost-neutral? (using 4% discount rate)



# Victorian Healthy Homes Program – Summary

- The Victorian Healthy Homes Program is the first comprehensive evaluation of the thermal comfort, energy use and health impacts of home upgrades
- First of its kind, conducted as a randomised controlled trial in Australia
- Delivered energy efficiency and warmth upgrades to 1000 vulnerable, low-income households in Victoria, free of charge to the participant, on average experiencing low quality of life
- Increased mean temperature increase by 0.33°C, reduced exposure to harsh conditions, most benefit in houses with low RES ratings
- Positive effect on health and social care related quality of life, particularly mental health
- Small impact on healthcare utilisation
- Mean ICER \$15,232 per 1°C increase in mean indoor temperature.
- Cost-neutral by year 7

# Funding and program delivery

## Funding

The Victorian Healthy Homes Program is funded by the Victorian Government.

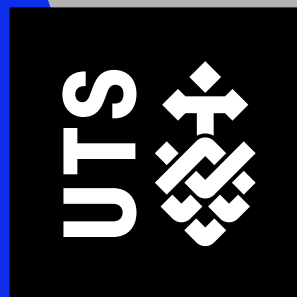


## Program delivery

- The program is delivered by Sustainability Victoria in association with the Australian Energy Foundation and the University of Technology Sydney's Centre for Health Economics Research and Evaluation and the Institute for Sustainable Futures.



Thank  
you



# Victorian Healthy Homes Program – Summary

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