

Technical Report

Understanding Shared Experience of Urban Heat
and Climate Change:

CITIZENS' DIALOGUE ON HOUSEHOLD HEAT MANAGEMENT & LEVERS FOR SUPPORT

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Understanding Shared Experience of Urban Heat and Climate Change: Citizens’ Dialogue on Household Heat Management and Levers for Support

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Table of Contents

EXECUTIVE SUMMARY	
1. Introduction	2
2. Methodology	5
2.1 Sampling Frame	5
2.2 Protocol and Programme.....	5
2.3 Survey Instruments and Measurements	7
3. Sample Description	9
4. Baseline Climate Change Outlook and Everyday Cooling Practices	11
4.1 Section Highlights	11
4.2 Outlook on Climate Change and Relationship with Heat.....	12
4.3 Cooling Practices and Perceptions.....	13
4.3.1 Air-conditioning usage	13
4.3.2 Everyday cooling practices	14
4.3.3 Cooling motivation.....	17
4.3.4 Perceived effectiveness of current cooling practices and existing cooling knowledge.....	18
5. Workshop Outcomes: Shifts in Understanding, Attitudes, and Agency	20
5.1 Section Highlights	20
5.2 Promoting Sustainable Cooling Practices.....	21
5.2.1 Openness towards heat adaption	21
5.2.2 Perceptions of sustainable cooling adoption	21
5.2.3 Perceptions of sustainable cooling co-benefits	22
5.2.4 Perceived influence of cooling practices on climate change.....	24
5.2.5 Cooling-related effectiveness and knowledge.....	25
5.2.6 Likelihood of taking up actions related to sustainable cooling	27
5.3 Bridging Psychological Distance through Urban Heat.....	28
5.3.1 Climate concern and personal responsibility.....	28
5.3.2 Psychological distance to climate change	29
5.3.3 Perceived vs. actual climate and urban heat impacts in Singapore	31
5.3.4 Recognising the impacts of cooling choices on climate change	33
5.3.5 Receptiveness to climate inaction justifications.....	34
5.4 Responsibility Attribution Across Stakeholders.....	35
6. Discussion and Pathways Forward	37
6.1 Synthesis of Key Findings.....	37
6.2 Support and Enablers for Action	38
6.3 Pathways Forward for Citizen Engagement on Climate Change and Urban Heat	39
References	40
Supplementary Material	41

EXECUTIVE SUMMARY

Urban heat is intensifying and increasingly affecting residents' comfort, health, and energy demand. Strengthening household resilience requires not only technical solutions but also a clearer understanding of how residents perceive heat and climate impacts, and how these perceptions shape everyday cooling practices.

This report presents findings from Working Group 3 (WG3): Citizens' Dialogue, conducted under the project *Leveraging Shared Experience of Urban Heat and Bridging Spatial–Temporal Dissonance: Towards a Climate Resilient Citizenry (CRC)*. The dialogue aimed to strengthen understanding of climate and cooling science, foster climate concern, and equip residents with practical, low-cost strategies for sustainable cooling.

Dialogue Design and Scope

A total of 89 adult residents participated in a full-day workshop combining expert presentations, facilitated discussions on lived heat experiences, and participatory mapping activities on home cooling practices.

Surveys were administered throughout the programme. This mixed-methods design generated quantitative pre–post measures alongside qualitative insights into how residents experience, manage, and interpret heat.

Key Findings

Baseline Insights

- Heat is widely recognised as linked to climate change, but cooling decisions are typically reactive responses to discomfort rather than part of anticipatory or long-term planning.
- Air-conditioning dominates household cooling. While some adaptive practices exist (e.g. combining air-conditioning with fans or adjusting set-point temperatures), features such as timer usage remain underutilised..
- Non-mechanical cooling strategies (e.g., cooling attire, cold showers) are present but limited while natural ventilation is often constrained by noise, insects, odours, and privacy concerns.
- Across five considerations, cooling choices were primarily driven by cost, health, and impacts on other household members, followed by sustainability and impacts on others in Singapore.
- Participants reported moderate confidence in their heat adaptation strategies to keep cool at home but showed strong willingness to learn new approaches.

Workshop Outcomes

- Participants reported greater openness to heat adaptation, including willingness to tolerate higher temperatures and adopt strategies beyond air-conditioning.
- Trust that others would also adopt sustainable cooling increased, although participants remained more confident in their own actions than in collective uptake.
- Participants' understanding of sustainable cooling benefits broadened. While cost savings remained central, health, mental well-being, and intergenerational considerations gained prominence.

- Knowledge gains were strongest in understanding how airflow and physical design affect indoor thermal conditions.
- Despite the aforementioned shifts, cost and health remained the key drivers of cooling decisions.
- Participants also reported increased concern about climate change and reduced spatial disconnect with the issue. Temporal and social disconnect, however, remained largely unchanged.
- Responsibility for climate action was attributed primarily to government, followed by business and industry, indicating a persistent scalar disconnect in perceived individual influence relative to system-level change.

Implications and Enablers for Action

Findings suggest strong willingness to act but persistent practical constraints, as well as the need for calibrated knowledge to support sustained action. Three levels of enablers can help bridge this gap:

- Household-level supports: (a) practical learning materials, (b) solutions addressing non-cost barriers such as insects, noise, odours, and privacy concerns, and (c) subsidies to expand adoption of shading devices and other passive cooling aids.
- Community or building-level supports: (a) shared storage or decluttering facilities, (b) ventilation-friendly common spaces, and (c) peer diffusion through resident champions or hands-on sessions to normalise and spread practical cooling know-how.
- Policy-level supports: (a) broader and more flexible incentives for a wider range of cooling-related improvements, and (b) streamlined approvals for low-risk ventilation or shading retrofits.

Strategic Pathways for Citizen Engagement

The dialogue also offers broader lessons for future climate engagement:

- Dialogue as a learning platform: Combining science explanations with lived experience reduces psychological distance from climate issues and strengthens agency.
- Message framing: Grounding communication in cost and health while incorporating comfort and future-generation concerns maintains relevance.
- Building everyday adaptive capacity: Hands-on demonstrations enable residents to apply cooling strategies directly in their homes.
- Community-based initiatives: Ground-up initiatives and visible collective efforts can reinforce social norms and sustain engagement.

Contribution to the CRC Programme and Next Steps

The dialogue extends the findings from WG1 (Population Household Study) and WG2 (Ethnographic Household Study) by testing how information, dialogue, and hands-on activities can shift understanding and willingness to adopt sustainable cooling. These insights directly inform WG4 (Co-Design Workshop and Field Experiments) by identifying the practical constraints households face, the types of support residents find meaningful, the engagement formats that build agency and relevance, and the passive cooling strategies most ready for adoption. Together, these insights provide a foundation for designing and piloting resident-centred cooling interventions that are scalable and responsive to everyday lived conditions



Chapter 1

Introduction

1. Introduction

Citizens' dialogues constitute a deliberative platform that enables lay participants to learn essential information and discuss collectively on a given issue. For researchers, such dialogues provide a valuable setting to capture and examine public perceptions. Data is generated through an integrated methodological design, employing qualitative strategies (e.g. reflective activities, group discussions) alongside quantitative measures (e.g. fixed-choice questions, Likert-scale surveys). The benefits of citizens' dialogues have positioned them as a strategic methodological tool for engaging the public across a broad spectrum of topics, including driverless mobility (Chng et al., 2021), climate change (Cockerill et al., 2019) and genome editing (Dryzek et al., 2020).

In dense tropical cities such as Singapore, the confluence of climate change and the Urban Heat Island (UHI) effect presents heat as a mounting challenge. By the end of the century, Singapore's mean daily temperature is projected to rise by 1.4–4.6°C (National Climate Change Secretariat Singapore, 2016). This increase will intensify thermal stress, making urban heat an increasingly persistent feature of everyday life and affecting physical, psychological, and social resilience.

Despite the urgency of climate mitigation and adaptation, enabling everyday behavioural change at the individual level remains challenging. One explanation lies in temporal-spatial-scalar dissonance, where individuals perceive climate change is perceived as distant- occurring elsewhere, in the future, or affecting other groups, thus weakening individuals' sense of agency and urgency.

Urban heat, however, is immediate, tangible, and widely experienced. As such, it may function as a psychologically "near" phenomenon that anchors broader climate understanding and motivates action. This premise, together with increasing emphasis on people-centred approaches to climate action (Verfuerth et al., 2023), positions citizens' dialogues as a pertinent way to engage the public in climate discourse, using heat as a unique entry point.

This report presents findings from Working Group 3 (WG3) of the Climate Resilient Citizenry (CRC) programme. CRC is a transdisciplinary, multi-institutional research initiative which aims to establish a comprehensive understanding of how individuals in Singapore perceive climate change across temporal, spatial, and scalar dimensions, and how the lived experience of heat can activate meaningful climate action. CRC spans four Working Groups (WG) and WG3 focuses on engaging residents through a Citizens' Dialogue, building on key findings from WG1 and WG2, as outlined below.

WG1 (Population Household Survey) showed a notable gap between broad climate concern and everyday heat management. While climate change and rising temperatures were widely recognised, understanding of the local drivers of urban heat and how household cooling practices relate to them remains limited. Cooling practices vary between daytime and night-time and across household members, yet some strategies, particularly air-conditioning use, tend to be shared within households. The study also highlighted uneven cooling access and lived heat exposure across housing contexts and showed that indoor microclimates can diverge substantially from outdoor conditions. These insights informed the design of WG3's participatory activities, which focused on mapping heat and cooling practices within the home and in relation to other household members.

WG2 (Ethnographic Household Study) revealed personal heat management as highly contextual, emerging from inherited practices and beliefs, household dynamics and negotiations, and the broader interplay of financial, health, and social concerns. Importantly, participants' experiential and tacit knowledge of heat were found to hold potential as an adaptive resource for more resilient heat management. These insights shaped WG3 as a two-way engagement, aimed both at participants' climate literacy and heat management, and at understanding their perceptions and embodied knowledge of climate change and urban heat.

Findings from WG1 and WG2 further point to a persistent gap between lived heat experiences and the framing of everyday cooling practices as climate-relevant actions. While heat is widely recognised as a lived impact of climate change, its management is seldom discussed in climate terms. Air-conditioning, for example, is typically framed in terms of comfort or costs as a response to heat rather than as a behaviour that contributes to or could mitigate broader climate outcomes. Similarly, heat considerations are seldom incorporated into longer-term housing decisions such as renovation, layout or furniture placement, despite their long-lasting impact on thermal comfort. Findings also suggest limited effectiveness of natural ventilation. Together, these patterns underscore the importance of strengthening thermal literacy and sustainable cooling practices within the home.

The WG3 Citizens' Dialogue therefore aimed to build a shared understanding of climate science and local impacts; strengthen climate literacy, concern, and collective efficacy; and lay the groundwork for low-cost, low effort, but effective strategies for sustainable cooling. Specifically, WG3 seeks to address six broad research questions (RQs):

RQ1: What are the gaps in people's understanding of the relationship between heat, climate change, and their personal cooling practices?

RQ2: How do people experience and adapt to heat at home?

RQ3: What is the gap between people's current cooling practices at home and the full range of effective cooling strategies available, particularly those related to airflow and ventilation?

RQ4: How does knowledge-sharing influence people's ability and willingness to act in terms of their cooling practices?

RQ5: What themes and topics matter the most to people in discussions of heat, climate change and cooling?

RQ6: To what extent does the workshop improve understanding of climate change and heat, and positive climate outcomes?

Findings from the first three CRC WGs will directly support the final WG4 (Co-Creation Workshop and Field Experiments) by identifying salient gaps in sustainable personal heat management, prominent themes of interest among different sub-groups in the community, and effective knowledge sharing mechanisms.

As the first citizens' dialogue (referred to as "workshop" from hereon) focusing on climate action and adaptation at the personal scale, with heat as the distinct entry point to bridge the dissonance of climate change in Singapore, WG3 also serves as a case study of engaging the public in climate discourse through a relatable everyday experience.

Although both qualitative and quantitative data were collected throughout the workshop, this report focuses primarily on descriptive findings from survey responses administered at multiple stages of the programme. Further analyses, such as qualitative thematic exploration and multivariate modelling across sociodemographic profiles, are planned for subsequent academic publications.

The report proceeds as follows. The next chapter details the workshop methodology, including the sampling frame, protocol and programme, and survey instruments. The next section presents findings on participants' baseline climate change outlook and everyday cooling practices. The subsequent section then examines shifts in knowledge, attitudes, and perceptions, following the workshop. The report concludes with a discussion of implications and potential pathways for future citizen engagement and policy-relevant applications.



Chapter 2

Methodology

2. Methodology

2.1 Sampling Frame

The Citizens' Dialogue was conducted on 5 October 2025 with lay adult residents. Participants were recruited through a two-pronged approach involving 1) invitations to WG1 participants who consented to be re-contacted for future research, and 2) open recruitment through online advertisements via Telegram. All sign-ups were pre-screened and selected to ensure diversity across sex, age, ethnicity, dwelling type, and disconnection profiles¹ developed in WG1. A total of 120 participants were invited to participate in the dialogue. The final attrition rate of 25.8% resulted in a sample of 89 participants. Participants provided written consent and received remuneration for full attendance.

2.2 Protocol and Programme

The workshop was a full-day event lasting 8-hours with breaks at appropriate junctures to ensure that participants can learn, discuss and deliberate during the session. The dialogue was held in a large venue, with participants organised into 11 groups of 6–9. Each group was assigned at least 1 trained facilitator to facilitate the activities, foster respectful dialogue and encourage inclusive participation. To investigate potential differences in group dynamics and discussion outcomes among participants with varying disconnection profiles, groupings were assigned based on disconnection profiles to create groups with different disconnection typologies. Facilitators were blinded to the participants' disconnection profiles to avoid bias in facilitations.

The key activities of the workshop included two knowledge-sharing presentations on climate science and cooling science, alongside hands-on activities for participants to map out their lived experiences of heat at home. The first presentation covered the science behind climate change, projected impacts of climate change globally and locally in Singapore, while illustrating the linkages between climate change and heat. The second presentation focused on the physiological impacts of heat and personal cooling strategies, as well as home design strategies to improve natural ventilation and promote cooling. During the mapping activities, participants sketched their home layout and perceived airflow, while listing their cooling strategies at home. Mapping was conducted before and after the cooling science presentation to capture the impact of knowledge sharing in influencing participant' visualisation of their home ventilation and potential behavioural changes to achieve more effective cooling at home. Throughout the dialogue, group discussions took place at appropriate junctures to allow exchange of viewpoints and ideas among participants. The full programme is outlined in Table 1.

The study received approval from the SUTD Institutional Review Board (IRB-25-00753) and adhered to the principles of the 1964 Helsinki Declaration and its amendments. All study materials and procedures underwent ethical review. Informed consent was obtained from the participant before the workshop. Participation was voluntary, and respondents could opt out of any component. No personal identifiers were collected. Data were stored securely and accessible only to the research team.

¹ WG1 identified four “disconnection profiles” describing the perceived psychological distance of climate change and urban heat: distant (both perceived as distant), mixed (climate distant, heat close), moderate (both moderately close), and close (both very close).

Table 2.1 Citizens’ Dialogue Programme Outline

	<i>Segment</i>	<i>Activity</i>	<i>Purpose</i>	<i>Instrument</i>
1	Opening and Welcome	Introductory remarks; participant briefing	Set context; explain objectives	Pre-Workshop Survey (WS1)
2	Interactive Climate Science Presentation	Presentation + live poll	Improve understanding of climate change; link heat to climate; identify associations	(Learning segment) and live polls
3	Group Reflection on Presentation	Small-group dialogue	Capture misconceptions corrected; insights on heat–climate–cooling gaps	Sticky notes on group reflection sheets (GS1)
4	Mapping Home Environment and Heat	Mapping activity and small-group dialogue	Spatial-cognitive mapping of lived heat experience; identify strategies/barriers	Pre-Mapping Survey (WS2) + sticky notes on group reflection sheets (GS2) and hand-drawn maps
5	Mapping Airflow	Overlay airflow on home map	Identify baseline airflow understanding	Hand-drawn maps
6	Cooling Trivia	Live quiz	Reinforce knowledge	(Engagement only)
7	Cooling Science Presentation	Physiology + spatial design	Align cultural practices with scientific guidance; introduce passive cooling	(Learning segment)
8	Remapping Heat at Home	Redraw maps with new strategies	Apply new knowledge; reflect on constraints/support needed	Post-Remapping Survey (WS3) + sticky notes on group reflection sheets (GS3)
9	Group Sharing: Lessons and Priorities	Small-group deliberation	Identify salient topics; accessible strategies; support/resources	Sticky notes on group reflection sheets (GS4)
10	Post-Workshop Survey and Feedback	Individual survey	Assess workshop outcomes; gather feedback	Post-Workshop Survey (WS4)

2.3 Survey Instruments and Measurements

The workshop involved multiple surveys administered at different timepoints as outlined in Table 2.1. All surveys were completed using pen and pencil on paper. The survey worksheets are provided in the Supplementary Materials.

WS1 and WS4 used the same measures to assess changes in attitudes and knowledge pre- and post-workshop. The constructs assessed include climate attitudes such as climate concern and psychological distance towards climate change and heat, alongside climate–heat–cooling associations, climate inaction justifications, sustainable cooling attitudes, and perceived stakeholder responsibility. Perceived knowledge on climate change, UHI, linkage between climate change and heat, cooling practices and the impact of physical design on airflow and temperature were self-reported. Objective knowledge on climate change and heat in Singapore was also assessed via a short 5-item quiz. Aside from these repeated measures, WS1 additionally incorporated questions on participants’ air-conditioning exposure and usage practices.

Administered before the first mapping activity, WS2 served as a baseline measure of participants’ perceived cooling efficacy at home, understanding of airflow and ventilation, cooling motivations, relationship with heat as well as openness to learning. WS3 was subsequently administered to assess the effects of the spatial-cognitive mapping activities and knowledge presentation. In WS3, participants re-evaluated their cooling efficacy and understanding of airflow and ventilation. Intentions for future actions, applicability of knowledge shared, persisting barriers and support required were also collected.

All survey constructs, including theoretical sources, item counts, and scale types, are documented in Table S1 (Supplementary Materials).

In addition to the individual surveys, each group also completed 4 group reflection sheets. These group-sheets were completed as part of the group discussion segments where participants were encouraged to share their thoughts and reflect on the guiding questions as a group. The group-sheets were deliberately left unstructured, allowing participants to jot down their discussion points freely using the writing materials and sticky notes provided. The group-sheets were collected and thematically coded qualitatively to identify key themes of discussion.



Chapter 3

Sample Description

3. Sample Description

A total of 89 adult residents attended and participated in the full workshop activities. Table 3.1 summarises the sample characteristics across key socio-demographic factors. Overall, the sample reflected a broad representation across major demographic groups in Singapore.

Table 3.1 Participant characteristics

Sex, <i>n</i> (%)	
Female	50 (56.2 %)
Male	38 (42.7 %)
Prefer not to say	1 (1.1%)
Age group, <i>n</i> (%)	
Young adults (18-24)	19 (21.3 %)
Early adults (25-44)	31 (34.8 %)
Middle to late adults (45-64)	22 (24.7 %)
Seniors (65 and above)	17 (19.1 %)
<i>mean; range</i>	42.7 ; 18-76
Ethnicity, <i>n</i> (%)	
Chinese	75 (84.3 %)
Malay	4 (4.5 %)
Indian	9 (10.1 %)
Others	1 (1.1 %)
Education, <i>n</i> (%)	
N/O levels	13 (14.6 %)
Nitec/Higher Nitec	4 (4.5 %)
A levels/Diploma	31 (34.8 %)
Bachelors	33 (37.1 %)
Postgraduate	8 (9.0 %)
Employment, <i>n</i> (%)	
Employed	42 (47.2 %)
Unemployed, Not in Workforce (Including Students)	33 (37.1 %)
Unemployed, Job-Seeking	9 (10.1 %)
Prefer Not to Say	5 (5.6 %)
Residency Status, <i>n</i> (%)	
Singapore Citizen or Permanent Resident (PR)	86 (96.6 %)
Non-Citizen or PR	3 (0.4 %)
Dwelling Type, <i>n</i> (%)	
HDB 1-2 Room	7 (7.9 %)
HDB 3 Room	16 (18.0 %)
HDB 4 Room	36 (40.4 %)
HDB 5 Room / Executive	24 (27.0 %)
Condominium	5 (5.6 %)
Landed Property	1 (1.1 %)
Disconnection Profile, <i>n</i> (%)	
Distant	9 (10.1 %)
Mixed	15 (16.9 %)
Moderate	18 (20.2 %)
Close	47 (52.8 %)
Total number of participants	89



Chapter 4

Baseline Climate Change Outlook and Everyday Cooling Practices

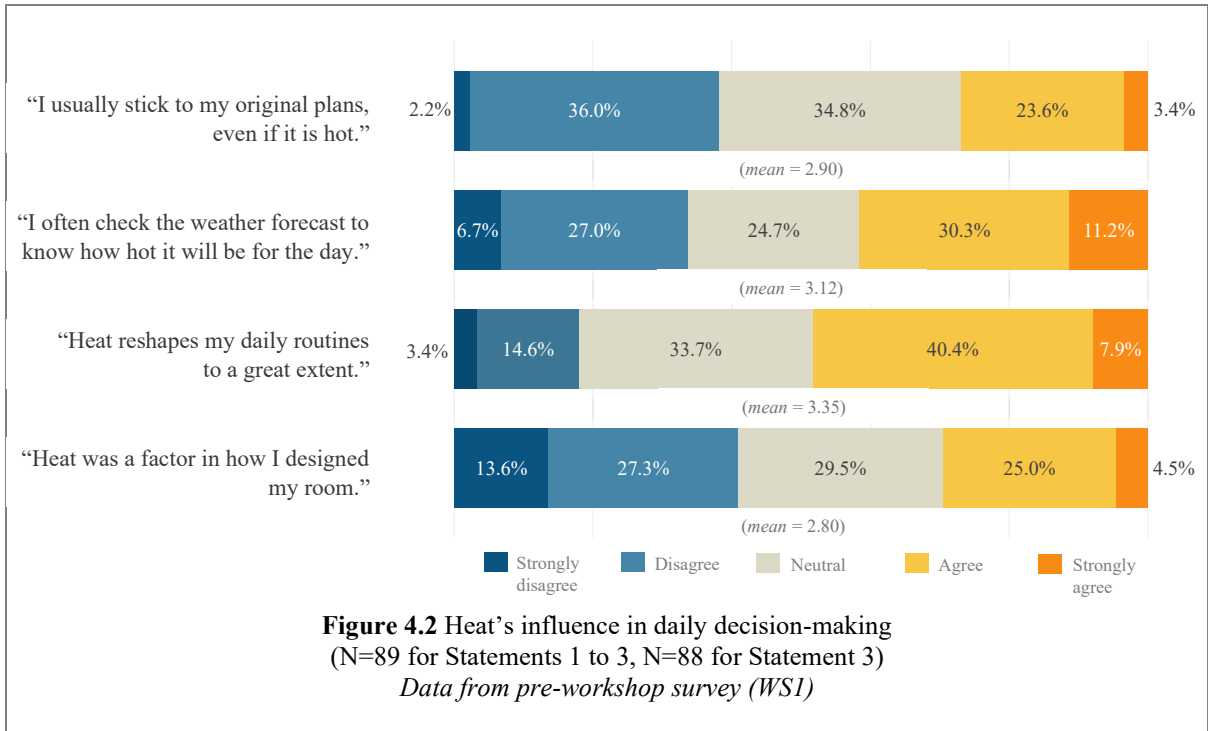
4. Baseline Climate Change Outlook and Everyday Cooling Practices

This section establishes the baseline of participants' perspectives and behaviours at the start of the workshop. It explores their initial cognitive associations with climate change and their everyday cooling practices including patterns of air-conditioning usage, reliance on natural ventilation, and the motivations driving cooling choices. These baseline insights provide a foundation for interpreting subsequent shifts in knowledge, attitudes and behaviours observed after the workshop.

4.1 Section Highlights

Key findings of this section are as follows:

1. **Heat is linked to climate change but managed reactively:** Participants do widely associate heat with climate change, but incorporating heat into decision-making is often a more reactive response than proactive planning in everyday life.
 2. **Air-conditioning is used adaptively but not necessarily optimally:** Among air-conditioning owners, pairing it with fans and adjusting temperatures are common practices in actively managing comfort at home, but timers are underused.
 3. **Mechanical cooling dominates everyday practices:** Participants are primarily relying on mechanical cooling even though non-mechanical strategies such as wearing cooling attire and taking cold showers are common. The optimal use of natural ventilation is also constrained by sensory and environmental barriers to opening doors and windows.
 4. **Cost and health drive cooling decisions:** Across five considerations, cost, health, and impacts on other household members emerged as the primary drivers of cooling choices, followed by sustainability and impacts on others in Singapore.
 5. **Baseline confidence is moderate while openness to learning is high:** Participants report moderate confidence in perceived efficacy of current adaptation practices at home, with high willingness to learn new approaches to adapting heat.
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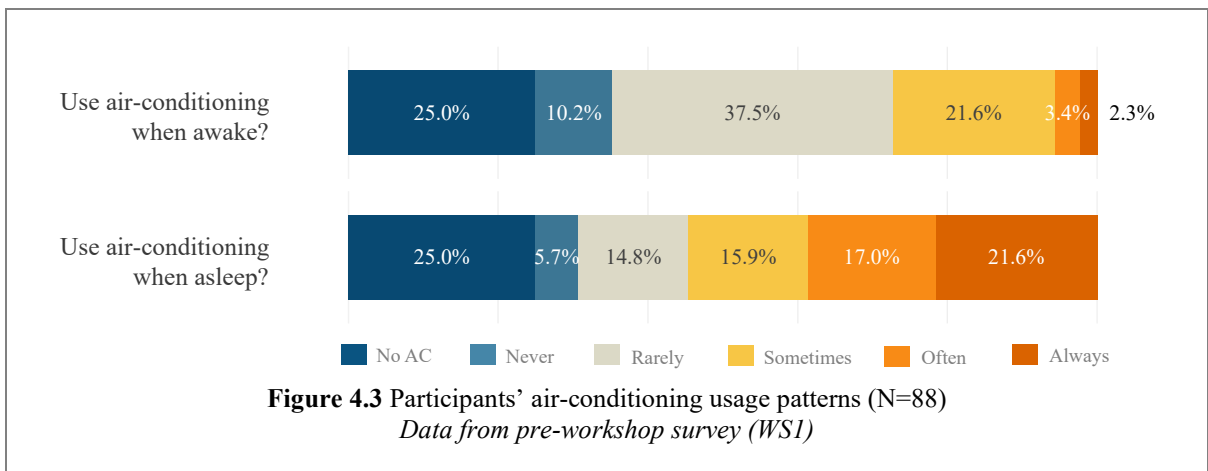


4.3 Cooling Practices and Perceptions

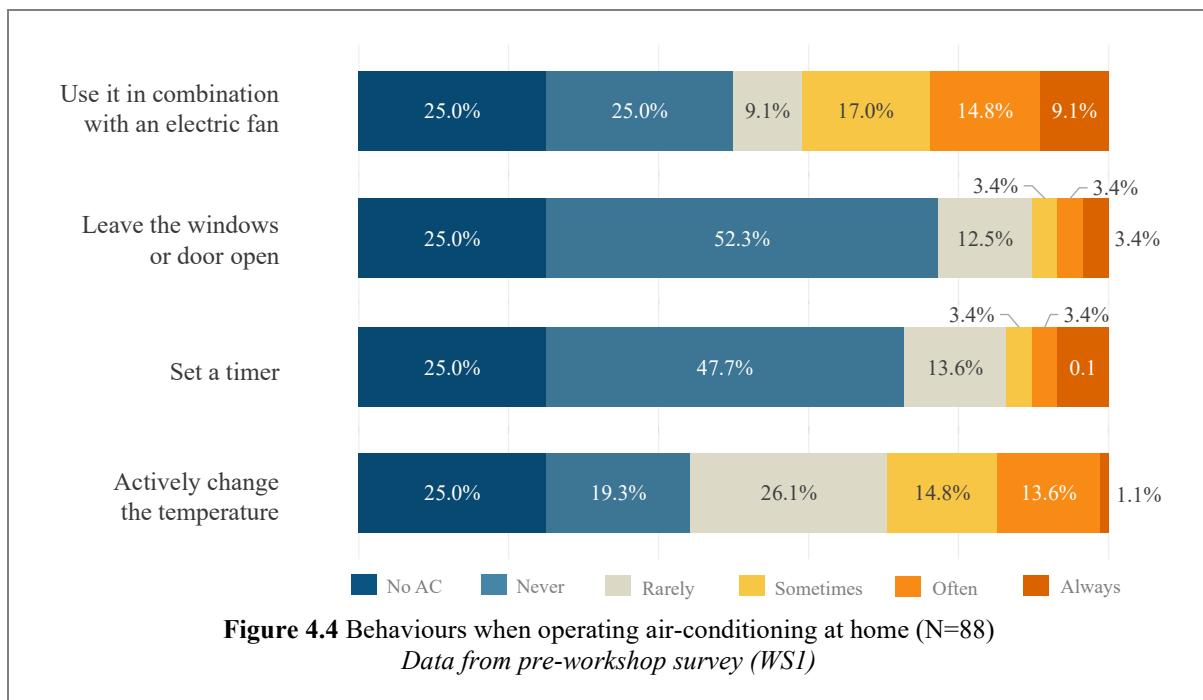
4.3.1 Air-conditioning usage

Air-conditioning ownership is high, but active usage is context dependent. 75% of participants reported having air-conditioning at home, with the median temperature at which they set their air conditioning to being 25°C.

When awake, only 5.7% of participants reported frequent or consistent use, indicating reliance on alternative strategies throughout the day. This pattern does not necessarily imply low daytime aircon exposure, as the question focused on home settings. Given that many Singapore residents work in air-conditioned offices, the low usage at home while awake may reflected limited time spent there rather than avoidance of air-conditioning as a method of cooling. In contrast, nighttime usage was substantially higher, with 38.6% reporting frequent or consistent use, underscoring its importance for comfort during sleep.



When using air-conditioning, pairing it with fans (hybrid cooling) is relatively common among those who own it. Overall, 23.9% reported often or always using a fan with air-conditioning. Given that 25% have no air-conditioning, that translates to about 32% of air-conditioning owners adopting hybrid cooling. Windows and doors are rarely kept open when the air-conditioning is on with only 10.2% overall (13.6% of air-conditioning owners) reporting “sometimes” or “often” or “always” leaving openings ajar. This suggests awareness of cooling efficiency and energy conservation. Timers are severely underused. Only about 3.5% overall (about 4.7% of air-conditioning owners) reported often or always setting timers. This is a concrete opportunity area as timers can cut unnecessary runtime, complement hybrid cooling, and translate knowledge gains into everyday savings. In contrast, manual temperature adjustments are more common. 14.8% said they would sometimes do this while 14.7% said they would either often or always do this. This amounts to about 19.6% of air-conditioning owners either often or always adjusting the set point, suggesting that many households are actively managing comfort.



4.3.2 Everyday cooling practices

Over 63% of participants reported relying on methods other than air-conditioning to stay cool at home. The mapping activity and group discussions surfaced a variety of everyday cooling practices. Tacit practices such as time-of-day fan behaviour, improvised shading, and cultural beliefs about post-exercise cooling indicate embodied knowledge that guide daily actions (and importantly, can be actionable on an intervention-level) but is still under-researched. Mechanical cooling, including the use of fans and adaptive air-conditioning, emerged as the dominant strategy, while non-mechanical approaches such as wearing cooling attire and taking cold showers were also commonly reported, indicating behavioural adaptation beyond devices alone. Practices related to spatial design and ventilation management, primarily through opening doors and windows, were frequently mentioned, suggesting sustainable cooling behaviours are already in use. Some participants also reported relying on public spaces for thermal relief, raising considerations related to shared infrastructure and equity. Table 4.5 summarises the cooling strategies surfaced during the workshop activities.

Table 4.5 Cooling strategies reported in group discussions (thematic extraction from group worksheets)

Cooling Strategies	No. of mentions
Mechanical cooling devices and energy usage	
Fans (ceiling, standing)	23
Adaptive or flexible usage of air-conditioning (hybrid cooling, limiting usage, using a timer, setting a fixed temperature)	23
Strategic adjustments to electrical appliance usage	13
Portable cooling appliances (handheld electric fan, desk fan)	4
Non-mechanical cooling devices / body-level coping and routine	
Wearing cooling attire	12
Showering in cold water	11
Consuming cold liquids	8
Sleeping on cooling material	5
Cooling wipes or wet towels	3
Using handheld fans	3
Exercising in the heat to acclimatise	2
Using ice packs	2
Showering in warm water	2
Spatial design and shading	
Shading apparatuses (e.g. window films)	11
Usage of plants for cooling	8
Decluttering to allow better ventilation	7
Replacing curtains with blinds	1
Ventilation management	
Opening doors and windows	22
Ventilating hotspots in the home	3
Combatting air pollution using air purifiers and filters	4
Out-of-home coping strategies (such as looking for cooled public spaces outside the house)	13

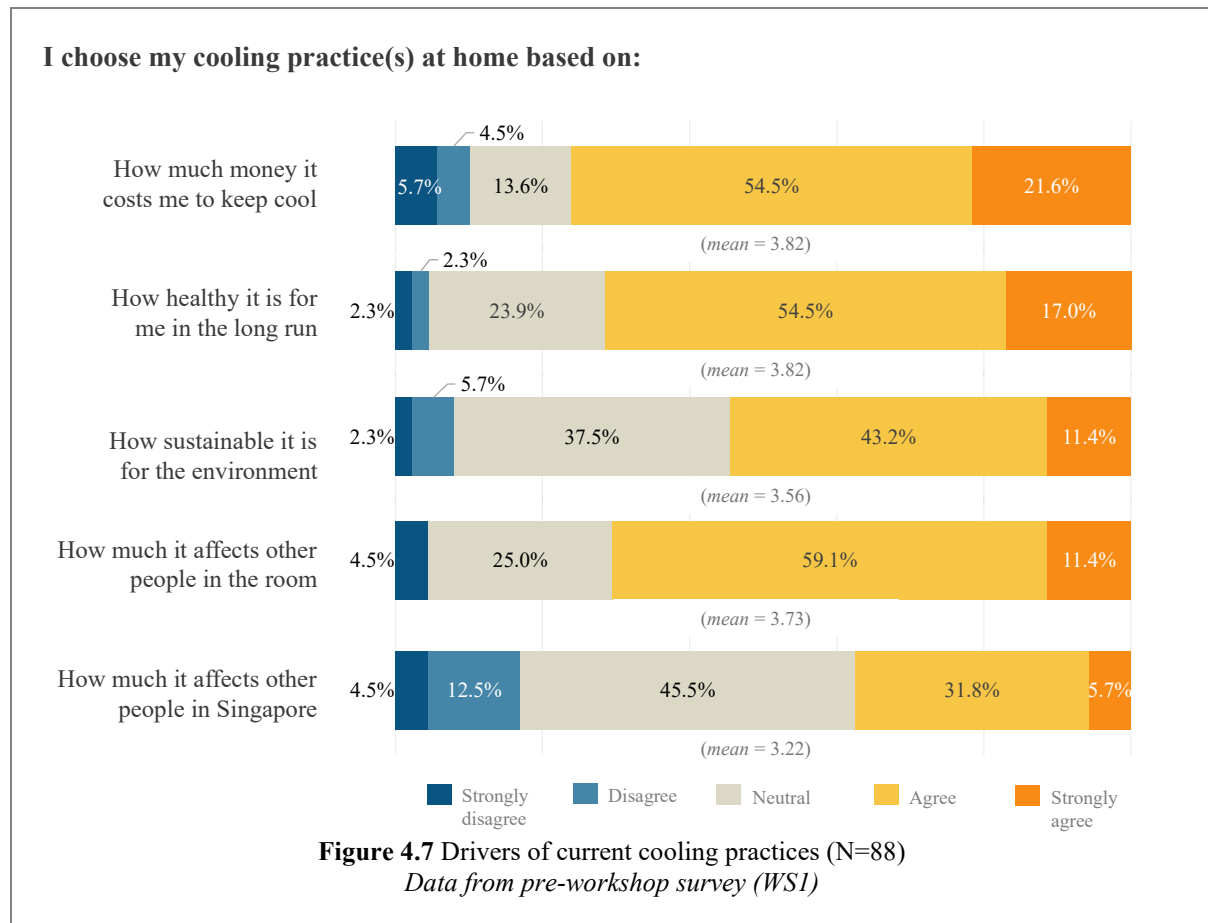
While natural ventilation strategies are common, they are not fully optimised. From the discussions, fuller adoption of natural ventilation is constrained by various factors, most prominently sensory and environmental constraints such as air pollution, insects, noise, and odours. Privacy concerns are also notable barriers. Certain structural features, including unit orientation, window sizes, and crowded HDB building layouts, can also be barriers as they limit airflow paths. While these structural barriers are difficult to overcome, findings which this report later present shows how tackling ventilation literacy and improving people’s willingness to adopt sustainable cooling offers a promising path forward in expanding people’s agency in heat management improvement at home. The group discussions also surfaced other important challenges to cooling at home including interpersonal negotiations among family members, inconvenience and general reluctance to change personal routines, and costs. A summary of the barriers to sustainable cooling identified through the group discussions are provided in Table 4.6.

Table 4.6 Barriers to cooling reported in group discussions (thematic extraction from group worksheets)

Barriers	No. of mentions
Structural	
Building orientation or location	6
Building materials or design (e.g. window sizes, paint)	6
Building crowdedness	2
Shrinking floor areas	1
Sensory/environmental	
Air pollution	7
Insects	7
Noise	6
Odours (food, rubbish, smoke)	3
Animals (birds, rats)	2
Social/cultural	
Privacy concerns	12
Household negotiations (e.g. managing differing cooling preferences among members)	5
Behavioural/cognitive	
Acclimatisation to air-conditioning usage	1
Human error (such as forgetting to turn off the fan)	1
Inconvenience	1
Reluctance to change	1
Economic (costs)	3
Weather	
Strong winds entering open windows and doors	3
Splashes of rain entering through open windows and doors	2
Governance and approvals (e.g. stringent approval processes for renovation)	4

4.3.3 Cooling motivation

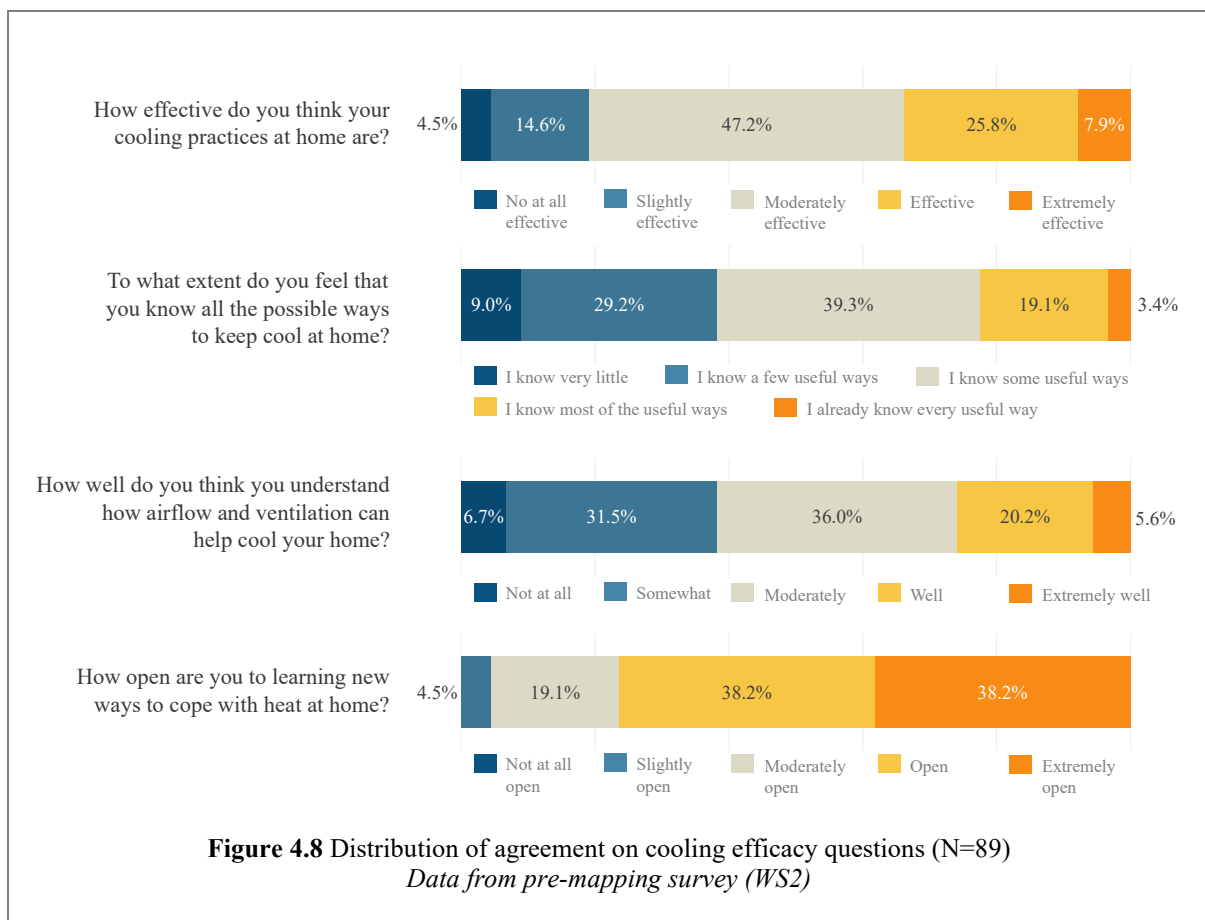
The data shows that there are three key drivers behind the choice of cooling practices: cost, health, and shared impacts among household members. Cost drives the cooling choices most strongly, with 76.1% agreeing that expenses influence their practice. This suggests interventions that promise bill savings will likely enjoy the fastest uptake. Health ranks second (71.5% agree or strongly agree) but the lower “strongly agree” share compared to cost suggests room to strengthen the health evidence and specificity of its relationship to cooling practices. Household social considerations also matter (70.5% agree or strongly agree), suggesting that messaging that frames shared comfort can leverage this motivation. Many are open to environmental arguments, with 54.6% agreeing or strongly agreeing with the statement, but points towards the need for translation into tangible gains to move behaviour. Community scale impact is the least salient with only 37.5% agreeing or strongly agreeing.



4.3.4 Perceived effectiveness of current cooling practices and existing cooling knowledge

Before the mapping exercise, a survey was administered to gauge participants’ perceptions of how effective their current cooling practices were and how much knowledge they believed they had about home cooling strategies. People generally believed their setups were sufficient: 47.2% found their cooling practices moderately effective while 33.7% found them either effective or extremely effective. Viewed in tandem with responses to the question on “knowing all the possible ways to keep cool at home,” however, this confidence reveals a gap wherein people report feeling confident in the ways they keep cool, yet only about 22.5% say they know “most” or “every” useful way, which means many may be achieving comfort with a narrow toolkit.

A substantial majority (76%) expressed strong willingness to learn new approaches to coping with heat, underscoring the considerable curiosity that heat management sparks in Singapore’s tropical context. This openness suggests that the participants are primed. As the results later show, the workshop content successfully converted this openness into practical adoption as participants report high levels of likelihood that they would take on sustainable cooling practices.





Chapter 5

Workshop Outcomes: Shifts in Understanding, Attitudes, and Agency

5. Workshop Outcomes: Shifts in Understanding, Attitudes, and Agency

The workshop incorporated a series of Climate and Cooling Science presentations addressing heat and cooling in the context of climate change, physiological responses and spatial design principles. These were designed to equip participants with a deeper understanding of everyday cooling strategies. The complementary mapping exercises served as scaffolds for activating tacit knowledge and facilitating behavioural planning. This section of the report evaluates the extent to which the workshop effectively employed urban heat as a lens to promote sustainable cooling, reduce psychological distance and address climate inaction.

5.1 Section Highlights

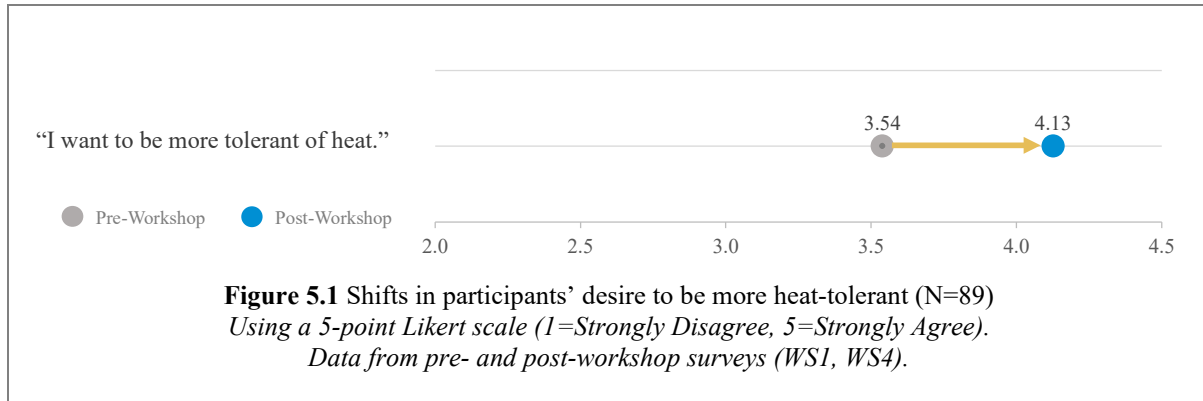
Key findings of this section are as follows:

1. **Increased openness to heat adaptation:** Participants showed a greater willingness to tolerate heat and rely on methods other than air-conditioning. Trust in others to adopt sustainable cooling also rose, though confidence in collective uptake remained lower than personal action.
2. **Broader recognition of co-benefits beyond environmental outcomes:** Participants increasingly recognised the multi-dimensional co-benefits of sustainable cooling and indicated a shift away from a predominantly cost-saving focus towards a wider range of perceived benefits including health, mental well-being, and impacts on future generations.
3. **Targeted knowledge gains, particularly in physical design and airflow:** Across five assessed knowledge domains, the greatest improvement was observed in participants' understanding of how physical design influences airflow and indoor temperature.
4. **Stability in primary motivations for cooling decisions:** Cost-saving and health benefits were identified as the most salient drivers of sustainable cooling, followed by household comfort, environmental, and societal benefits. This ordering mirrored pre-workshop motivations, indicating stability in cost and health as primary drivers of cooling-related decision-making.
5. **Specific narrowing of psychological distance dimensions:** Concern about climate change increased, and spatial distance reduced, with fewer participants perceiving Singapore as relatively "safe." Temporal distance remained largely unchanged, as future-generation framing continued to dominate. Social distance also showed little change, with low perceived relatability to disaster victims. Notably, while general perceptions of individual climate agency improved only marginally, confidence in the effectiveness of participants' own sustainable cooling practices for addressing climate change increased.
6. **Climate responsibility is primarily attributed to government rather than individuals:** Across pre- and post-workshop measures, participants consistently attributed primary responsibility for climate action to government, with business and industry viewed as secondary key actors over non-governmental organisations, the scientific community, and individuals. This pattern suggests a persistent scalar disconnect wherein individual responsibility and perceived effectiveness of personal actions are discounted relative to systemic and policy-led change.

5.2 Promoting Sustainable Cooling Practices

5.2.1 Openness towards heat adaption

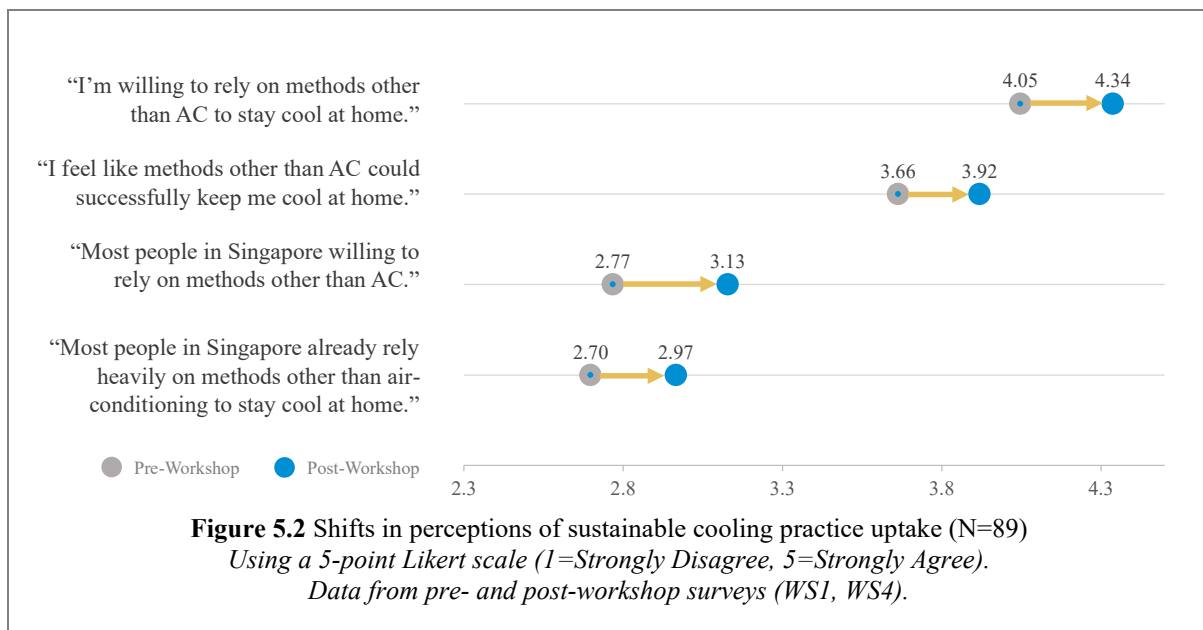
In addition to the openness participants displayed towards learning more about new cooling approaches, they also suggested an openness to behavioural adaptation. The item “I want to be more tolerant of heat” received moderate agreement at the beginning of the workshop and shifted further towards strong agreement by the end.



5.2.2 Perceptions of sustainable cooling adoption

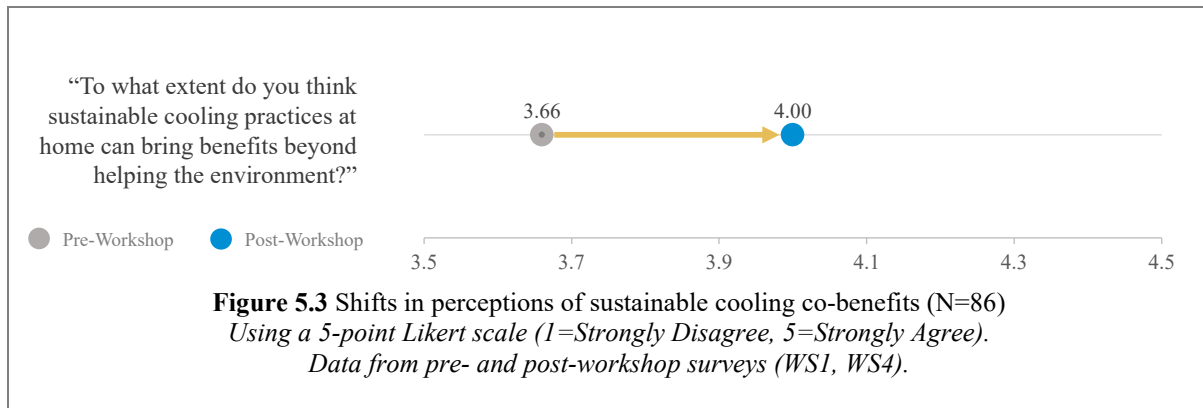
Participants reported a high level of willingness to adopt sustainable cooling strategies, but lower trust that other residents of Singapore were willing to or already doing the same. At baseline, participants generally agreed that they were willing to rely on cooling methods other than air-conditioning (mean = 4.05) and that such methods could successfully keep them cool at home (mean = 3.66). When it came to their perceptions regarding the actions of fellow Singapore residents, however, they remained neutral that others were willing to do the same (mean = 2.77) or already doing so (mean = 2.70).

Following the workshop, there were improvements across the board, meaning that not only were they more willing to personally rely on sustainable cooling methods, but they were also more trusting towards their counterparts to do the same.



5.2.3 Perceptions of sustainable cooling co-benefits

Prior to the workshop, participants moderately recognised the broader benefits (mean = 3.66) that sustainable cooling practices can bring beyond helping the environment. Post-workshop, there was a marked shift towards stronger recognition (mean = 4.00).



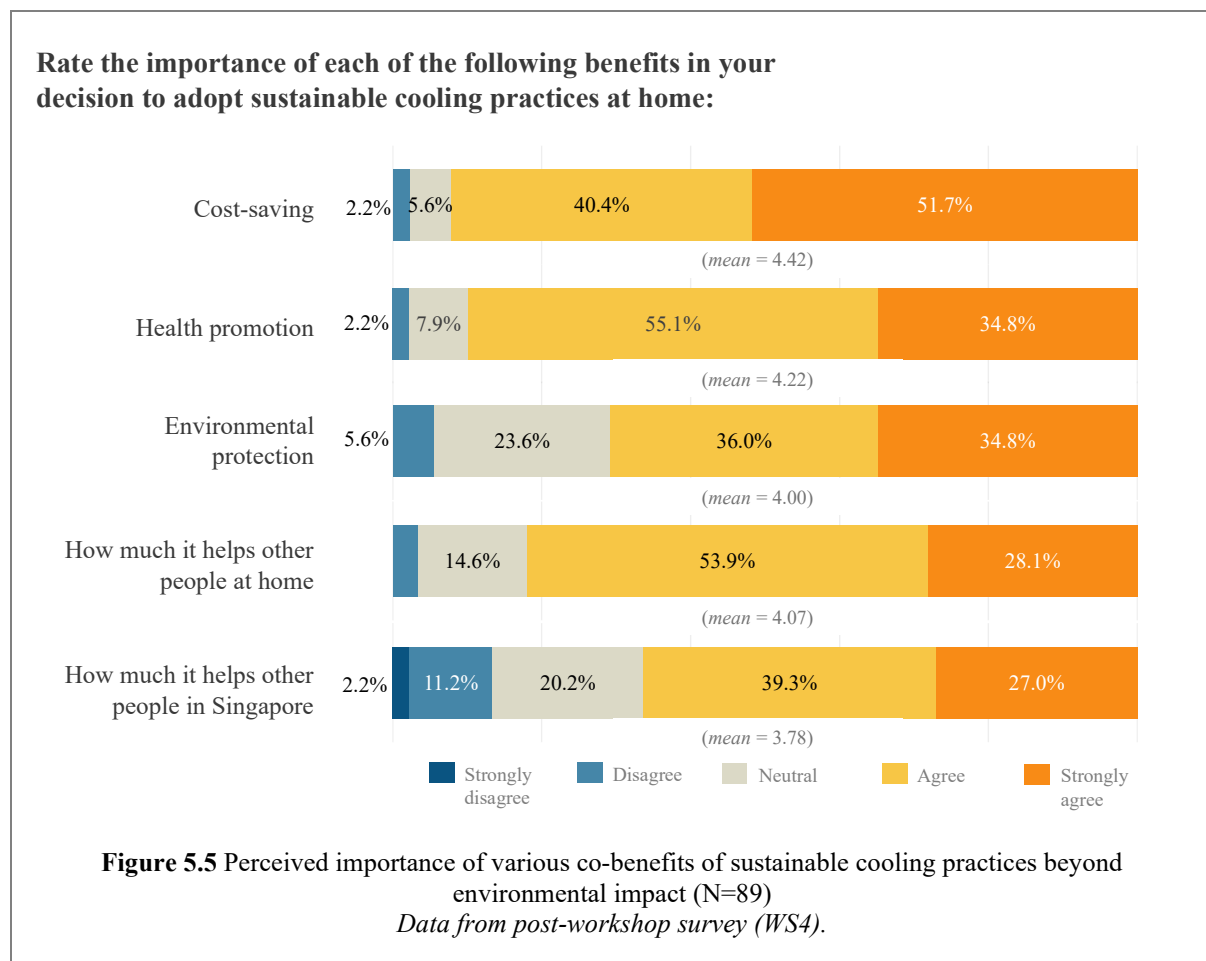
In their open-ended descriptions of co-benefits, responses before the workshop were dominated by personal cost savings (e.g., reduced electricity bills or lower utility costs). After the workshop, emphasis shifted from immediate cost towards broader, non-financial benefits. Mentions of environmental/sustainability and societal co-benefits rose alongside health and well-being framings. Taken together with the findings in Figure 5.3, the free-text evidence indicates that the workshop expanded the value proposition of sustainable cooling practices from saving money to healthier households and benefits for future generations. The results suggest participants increasingly appreciated the multi-dimensional benefits of sustainable cooling following the workshop.

We further asked them to rate the importance of five co-benefits in their decision to adopt sustainable cooling practices at home, a proxy measure to assess which factors participants saw as most personally relevant. The question set was designed to mirror the earlier items measuring general cooling motivations. While the earlier motivations capture baseline priorities in everyday cooling decisions, the co-benefits reflect what participants perceive as additional value in adopting sustainable cooling practices. Table 5.4 lists the specific wording of both question sets. The ordering of responses (Figure 5.5) closely mirrored participants’ earlier ratings of general cooling motivations (Figure 4.7), indicating consistency in decision drivers across contexts (general cooling and sustainable cooling practices).

Table 5.4 Questions asked when assessing cooling motivation factors vs. cooling co-benefits

	Cooling motivation	Cooling co-benefits
	<i>“I choose my cooling practice(s) at home based on:”</i>	<i>“Rate the importance of each of the following benefits in your decision to adopt sustainable cooling practices at home:”</i>
Cost	<i>“How much it costs me to keep cool”</i>	<i>“Cost-saving”</i>
Health	<i>“How healthy it is for me in the long run”</i>	<i>“Health promotion”</i>
Effect on other household members	<i>“How much it affects other people in the room”</i>	<i>“How much it helps other people at home”</i>
Environment	<i>“How sustainable it is for the environment”</i>	<i>“Environmental protection”</i>
Effect on other people in Singapore	<i>“How much it affects other people in Singapore”</i>	<i>“How much it helps other people in Singapore”</i>

Cost-saving ranked highest with 92.1% of participants agreeing or strongly agreeing that it was important. This indicates that financial benefits remain the most salient driver for adoption, aligning with participants' earlier qualitative emphasis on bills and energy savings as well as complementing the earlier findings on cooling motivations. In other words, cost drives cooling choices most strongly and driving down cost is seen as the most salient co-benefit of adopting sustainable cooling practices. Like the responses to the cooling motivation questions, health ranked second (89.9% agreed or strongly agreed), helping other people at home ranked third (82.0% agreed or strongly agreed), environment ranked fourth (70.8% agreed or strongly agreed), and helping other people in Singapore came in last (66.3% agreed or strongly agreed). This alignment suggests that core drivers of cooling decisions (financial and health considerations) are stable across contexts, while environmental and societal benefits are secondary, even if they are recognised. Such consistency in ordering across both question sets reinforces a key insight: to mainstream sustainable cooling, interventions should leverage the same motivational hierarchy that drives general cooling choices (cost and health) while making environmental and societal benefits more tangible and personally relevant. Linking sustainable cooling to visible household comfort improvements, health outcomes, and financial savings, while framing environmental and community benefits as co-benefits rather than primary drivers, may be the most effective communication strategy.

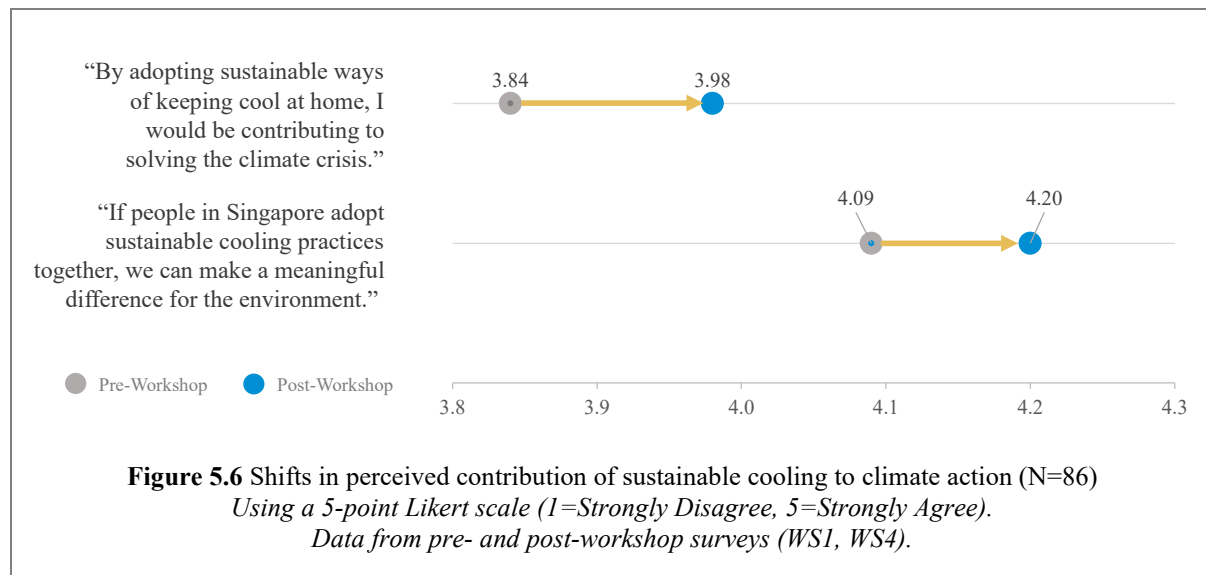


5.2.4 Perceived influence of cooling practices on climate change

Building on participants' recognition of co-benefits, Figure 5.6 illustrates how the workshop positively shifted perceptions of individual and collective impacts of sustainable cooling on climate change. Agreement was already high before the workshop, particularly for the statement emphasising collective action ("If people in Singapore adopt sustainable cooling practices together..."), which had a pre-workshop mean of 4.09 indicating general agreement. Post-workshop, this rose to 4.20, underscoring strong confidence in the potential of coordinated efforts to make a meaningful environmental difference.

For the statement linking personal action to climate crisis mitigation ("By adopting sustainable ways of keeping cool at home..."), the mean increased from 3.84 to 3.98. While the shift is modest, it signals a reinforcement of individual agency: participants increasingly see their own choices as part of the climate solution, complementing the earlier finding that sustainable cooling is perceived as offering multi-dimensional benefits.

Taken together, these results suggest that the workshop not only broadened participants' understanding of co-benefits but also strengthened their sense of efficacy at both personal and societal levels. However, the higher scores for the impacts of collective action compared to individual action indicate that scalar distance at the individual-level persists: participants are more confident in the impact of collective adoption than the significance of their own contribution.



5.2.5 Cooling-related effectiveness and knowledge

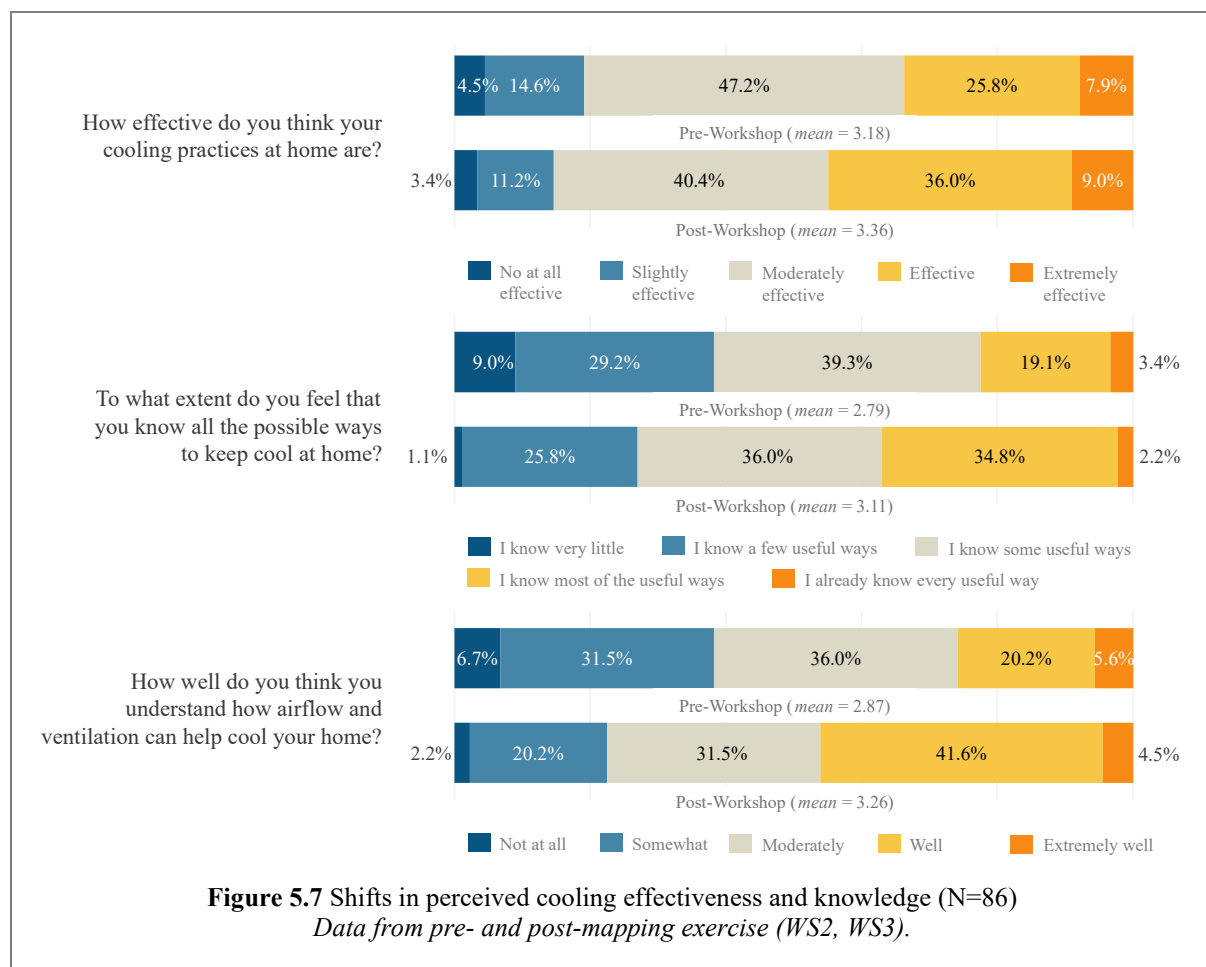
Surveys administered before and after the mapping exercise aimed to assess perceived effectiveness of existing cooling practices and literacy, with WS3 using a rephrased version of the same questions to evaluate whether the presentation and mapping activity influenced initial perceptions. Overall, participants demonstrated an increase in perceived cooling efficacy and know-how (Figure 5.7).

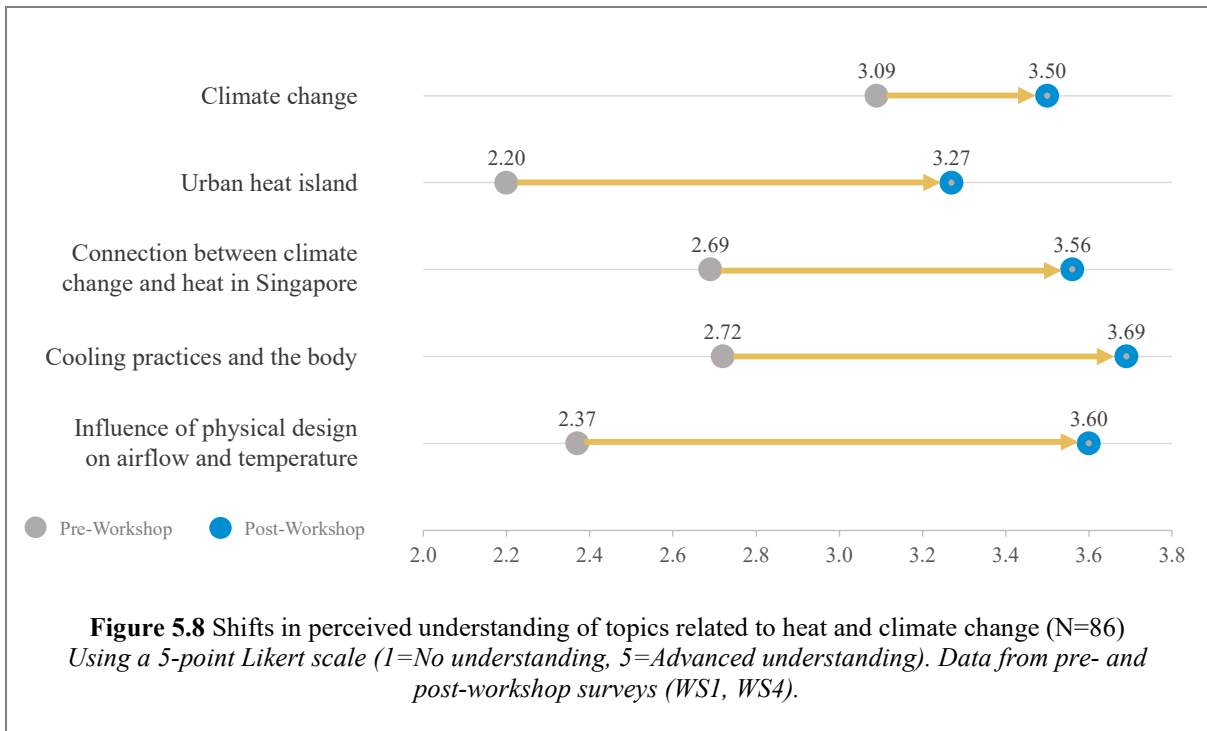
Confidence in current home cooling practices rose from a mean of 3.18 to 3.36, suggesting that participants learned optimisation strategies that make existing practices feel more effective.

The breadth of cooling know-how climbed more sharply from a mean of 2.79 to 3.11. In the free-text analysis, this know-how explicitly showcased itself in participants repeating strategies from the presentations including decluttering for airflow and setting a timer for air-conditioning.

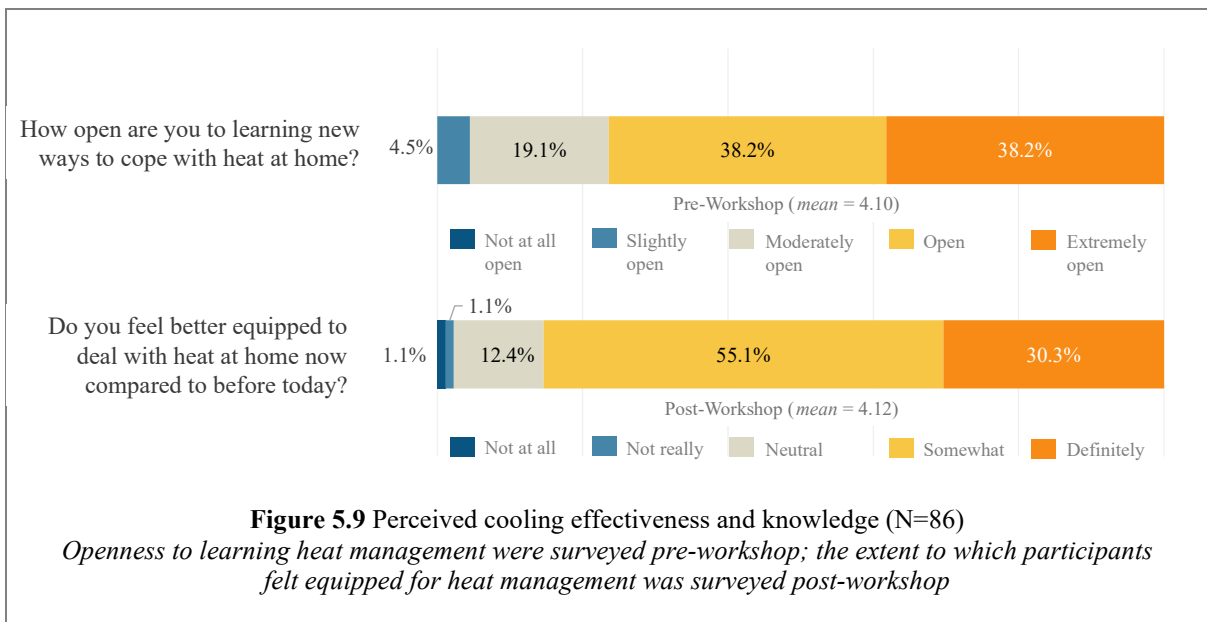
The most notable reported improvement was in understanding how airflow and ventilation contribute to cooling homes. Responses showed the largest jump from a mean of 2.87 to 3.26 (Figure 5.7).

As illustrated in Figure 5.8, there were also improvements across all five knowledge domains related to heat and climate change, underscoring the educational value of the workshop. Complementing the earlier finding on airflow and ventilation, knowledge about the influence of physical design on airflow and temperature showed the greatest post-workshop gain. This indicates that the workshop’s emphasis on ventilation, identified early on as a key knowledge gap, was appropriately targeted. Given that the earlier results established cost and health as the top adoption drivers, improved ventilation literacy is pivotal as it enables cost-saving (lower energy demand) while enhancing comfort and health (better thermal conditions and air quality), thereby aligning practical skills with the dominant motivations.





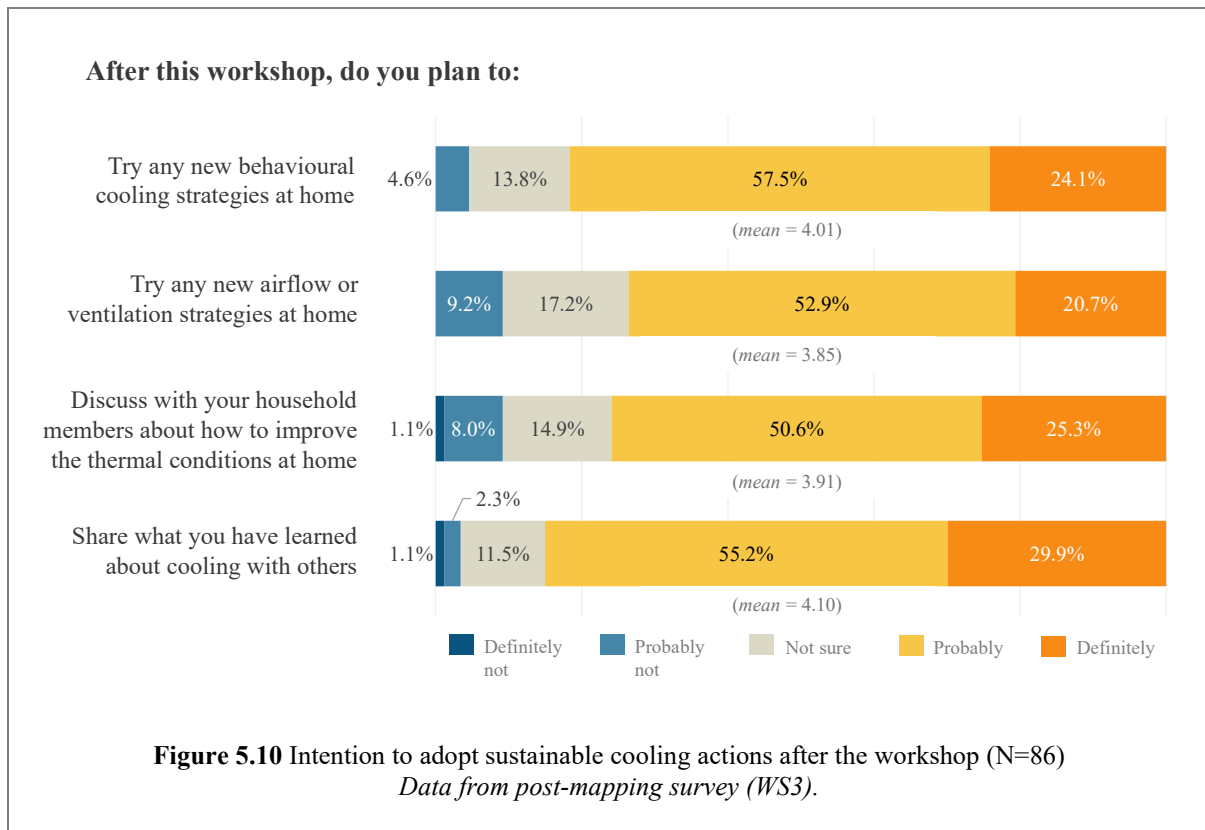
Moving to Figure 5.9, prior to the workshop, 95.5% of participants already expressed moderate to high openness to learning new ways of coping with heat. Following the workshop, 85.4% reported feeling “somewhat” or “definitely” better equipped to manage heat than before. Together, these results indicate that the workshop built on existing interest in the topic and strengthened participants’ perceived ability to manage heat in their homes.



5.2.6 Likelihood of taking up actions related to sustainable cooling

After the workshop, most participants indicated strong intention to take up specific actions, including adopting new behavioural and airflow strategies, discussing improvements with household members, and sharing learnings with others. Figure 5.10 represents the culmination of the workshop’s impact, wherein across all four items, responses cluster strongly around “probably” and “definitely,” with means near or above 4.0, signalling high readiness for behavioural change.

“Sharing knowledge with others” ranks highest (mean = 4.10), suggesting that the workshop fostered not only personal learning but also a sense of social diffusion, amplifying its potential impact beyond direct participants. “Trying new behavioural cooling strategies” (mean = 4.01) and “discussing improvements with household members” (mean = 3.91) also score strongly, indicating participants are prepared to translate knowledge into household-level action, which is a critical step given earlier findings that household benefits were rated more important than societal benefits in adoption decisions. Trying new airflow or ventilation strategies (mean = 3.85) ranks slightly lower but remains high, reflecting the workshop’s success in closing knowledge gaps around ventilation. This is significant because ventilation literacy was the largest knowledge gain post-workshop, and now participants express willingness to apply it.



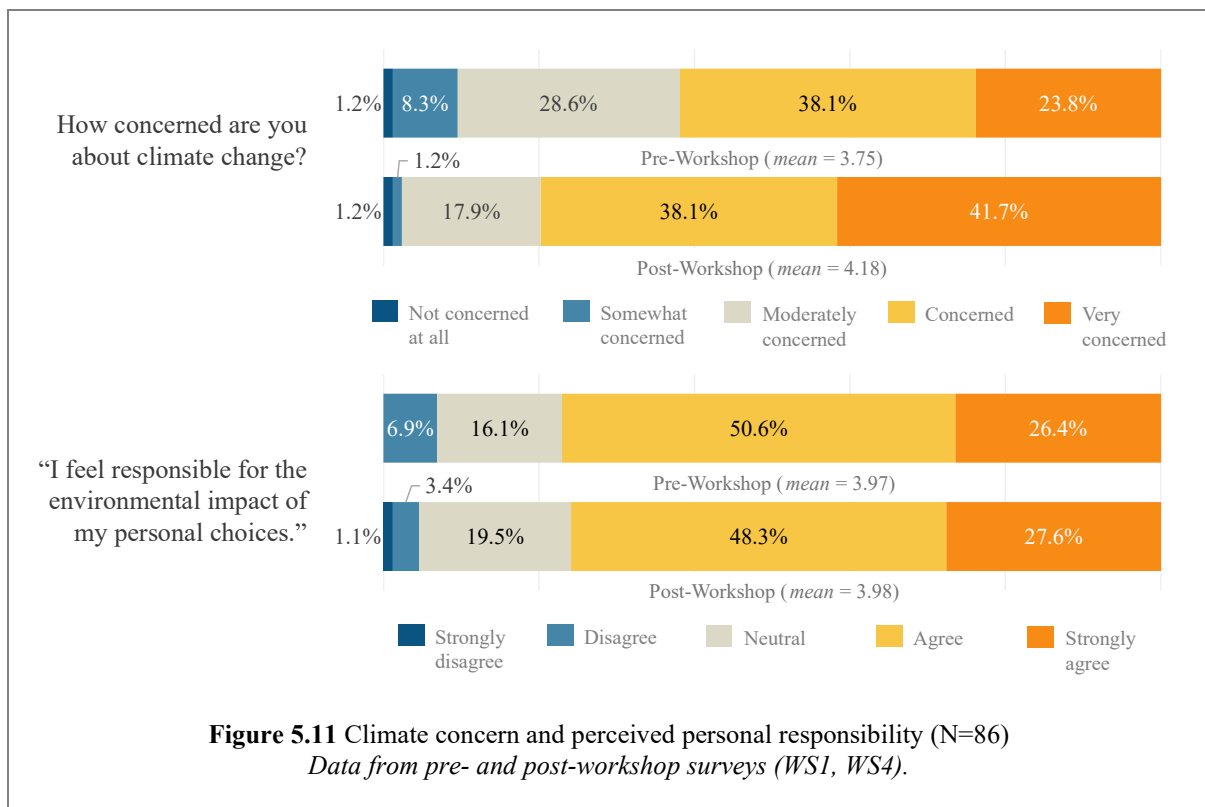
5.3 Bridging Psychological Distance through Urban Heat

Through the presentations and deliberations, the workshop reframed urban heat as a tangible expression of climate change with local consequences, linking personal cooling choices to broader environmental impacts. This resulted in increased concern about climate change and a stronger sense of personal responsibility, alongside the narrowing of specific dimensions of psychological distance.

5.3.1 Climate concern and personal responsibility

Concern about climate change increased markedly as shown in Figure 5.11: the share of “very concerned” responses almost doubled (from 23.81% to 41.7%), and the mean score shifted from 3.75 to 4.18. This suggests the workshop successfully amplified climate salience by connecting global risks to immediate, lived experiences of heat.

Sense of personal responsibility remained high with minimal changes (mean of 3.97 to 3.98). This stability once again points towards a persistent scalar disconnect. As participants deliberated on system factors, the extent of individual responsibility may have remained limited relative to institutional or collective action.



5.3.2 Psychological distance to climate change

Shifts in the various dimensions of disconnect with climate change were nuanced as shown in Figure 5.12. For all five dimensions, higher mean scores (stronger agreement) indicate greater distance.

Temporal distance emerged as the top disconnect with 91.9% of participants initially agreeing to the statement that climate change will impact future generations more than the current generation. After the workshop, this number rose to 95.4%, indicating a persistent future-oriented framing whereby participants continue to see climate impacts in a future lens, even if they recognise local heat today.

Spatially, however, participants improved in connecting local realities to global climate risks. Responding to whether they saw Singapore as relatively safe from climate change compared to other countries, the majority disagreed both pre and post, with disagreement strengthening in share post-workshop (from 54.0% to 62.1%). Despite a small mean change, the distribution shifts indicate participants became less likely to see Singapore as “safe”, suggesting that the workshop narrowed spatial distance in its use of urban heat as a lens. This converges with the knowledge gains in participants’ understanding of “urban heat island” and “connection between climate change and heat in Singapore” outlined earlier in Figure 5.8.

Regarding social distance, as seen in participants’ responses to the statement assessing if they could relate to victims of climate-related disasters, the mean remained low (from 2.56 to 2.52) with an uptick in strong disagreement (indicating reduced social disconnect). Relatability to climate-disaster victims, therefore, improved slightly which suggests that the workshop’s focus on making climate impacts more relatable through heat was effective at closing in on social distance.

Scalar distance also declined as the mean level of agreement decreased from 2.26 to 2.05, indicating greater individual efficacy. This aligns with the earlier improvement on the item “By adopting sustainable ways of keeping cool at home, I would be contributing to solving the climate crisis” in Figure 5.6. Together, they show that the workshop strengthened both domain-specific (cooling) agency and general climate agency.

Finally, responses on epistemic certainty (hypothetical distance) regarding climate science became more polarised following the workshop. While the mean increased from 3.69 to 3.89 and strong agreement rose which indicates greater scepticism, disagreement also increased at the lower end. The most notable change was a sharp decline in neutral responses, indicating that participants moved away from neutral positions and towards clearer, but divergent, views. Notably, this shift occurred alongside the improved knowledge gains in understanding climate change reported earlier (Figure 5.8), suggesting that greater familiarity with the topic may also prompt closer scrutiny of climate-related claims. Future interventions may therefore benefit from myth-busting and clearer presentation of locally grounded evidence to reduce confusion and support informed understanding.

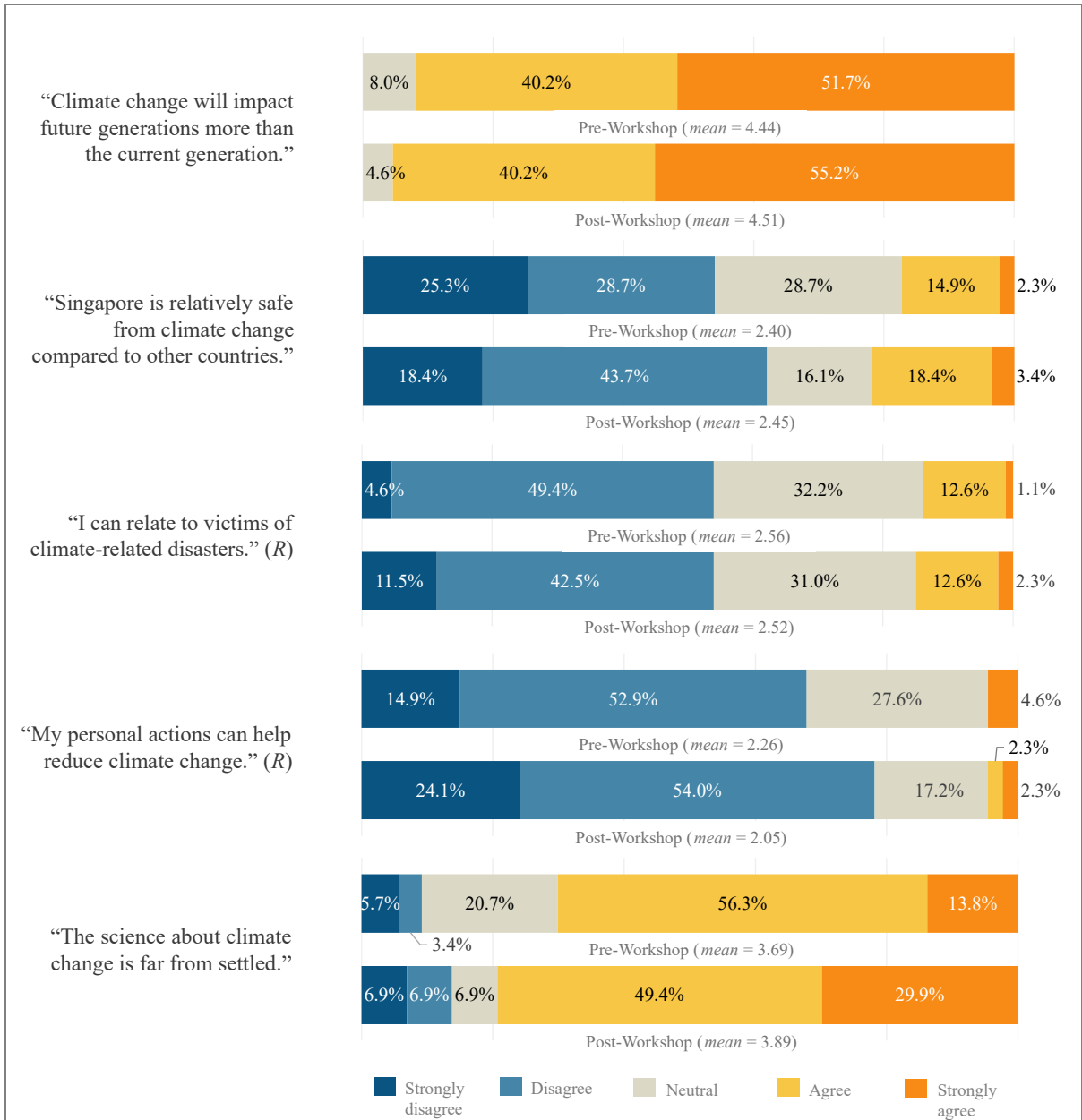


Figure 5.12 Temporal, spatial, social, scalar and hypothetical disconnects (N=87)
 Items marked with (R) were reverse scored. Data from pre- and post-workshop surveys (WS1, WS4).

5.3.3 Perceived vs. actual climate and urban heat impacts in Singapore

At the start of the workshop, participants answered multiple-choice quiz questions assessing their estimation of how climate change relates to heat in Singapore. The questions were purposefully designed to identify whether they overestimated or underestimated Singapore's contribution to or exposure from climate change, rather than to test factual knowledge. These questions were revisited and discussed during the workshop, and the same quiz items were administered afterwards to examine shifts in understanding. The results showed the expected convergence with fewer participants underestimating or overestimating the impacts after the workshop. These are depicted in Figure 5.13.

Regarding how fast participants thought Singapore was warming compared to the global average over the last half century, data shows it has been warming about twice as fast. 57% of participants correctly guessed this at the start. This number increased to 62.8% post-workshop. Those who overestimated Singapore's warming, however, also increased from 18.6% to 20.9%. Those who underestimated the warming ("2x slower" or "about the same rate") decreased. The modest increase in correct answers suggests the workshop improved factual understanding of Singapore's accelerated warming. The simultaneous rise in overestimation, however, indicates that while participants grasped the direction of the trend, some may be overcorrected, reflecting heightened concern but also potential misconceptions. The finding suggests urban heat as a lens works as it makes climate change feel locally relevant and urgent.

A similar misconception can be seen for responses to the question about how a typical person in Singapore compares to the global average when it comes to the negative impact of everyday actions in Singapore. Data shows that per capita consumption-based CO₂ emissions in Singapore is twice the global average. Only 19.8% of participants correctly guessed this at the start, but by the end, 60.5% selected the correct answer. This shows that the workshop was highly effective in clarifying Singapore's disproportionate per-capita climate impact, which is a critical fact for reducing scalar disconnect and fostering responsibility. Those who underestimated and selected "same" decreased by half, while those who severely estimated and selected "half" increased slightly. Those who overestimated and selected "5x the global average" also increased, suggesting that while the urgency messaging landed, some participants once again overcorrected.

The quiz included two questions on the impacts of air-conditioning usage. One question linked the impact of setting different air-conditioning temperatures on electricity savings, aimed at appealing to the connection that participants were predicted to make between cost and cooling practices. The other question assessed how much hotter participants thought typical air-conditioning usage in Singapore made the city's air temperature.

Research shows raising the air-conditioning temperature by just 1°C could save between 5-7% in electricity usage. Only 30.2% guessed correctly, with this number increasing to 55.8% by the end. Those who overestimated by selecting 7-10% remained the same, while those who underestimated by selecting 2-5% decreased slightly and those who severely underestimated by selecting less than 2% increased slightly from 8.1-9.3%. The jump in correct answers suggests the workshop effectively conveyed a practical, actionable fact – a fact that is critical because cost-saving is the top motivator for cooling choices, and this knowledge directly links sustainable behaviour to financial benefit. However, the persistence of severe underestimation, and unchanged overestimation suggests that some still miscalibrate the impact.

The only question that saw a decrease in proportion of correct answers pre- and post-workshop was the second air-conditioning usage impact question wherein only 17.4% of participants answered that typical air-conditioning usage in Singapore increased the city's air temperature by 3-4%, compared to the 25.6% which initially answered this. The workshop did not, therefore, successfully reinforce this specific fact about air-conditioning's contribution to urban heat. The rise in both over- and underestimation (despite a slight decline in severe underestimation) indicates that the link between individual air-conditioning usage to aggregate urban heat effects is more abstract.

The final question gauged participants' perceptions of climate change's impact on Singapore. If the world continues business as usual and does not reduce our climate impact ("high emissions pathway"), Singapore will experience 326 days of high heat stress above 33°C annually by 2080-2099. Only 19.8% of participants correctly selected this answer, but by the end, this number rose to 48.8%. There was a decrease in both the proportion of participants who underestimated and overestimated this. The decline suggests greater alignment with scientific projections, though the presence of underestimation signals that some participants still minimise future risk.

Across all quiz questions, the proportion of those who selected "I don't know" fell pre- and post-workshop.

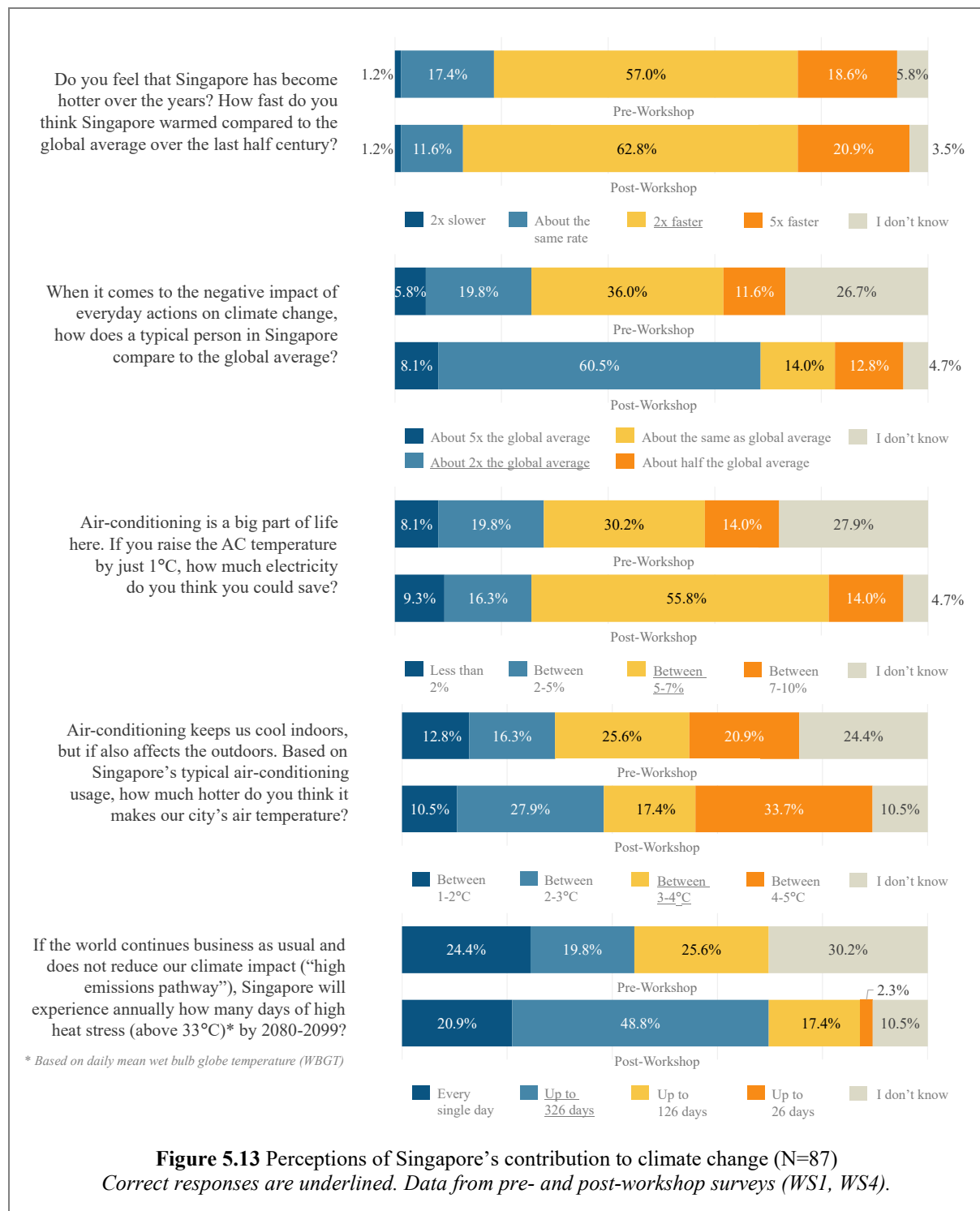
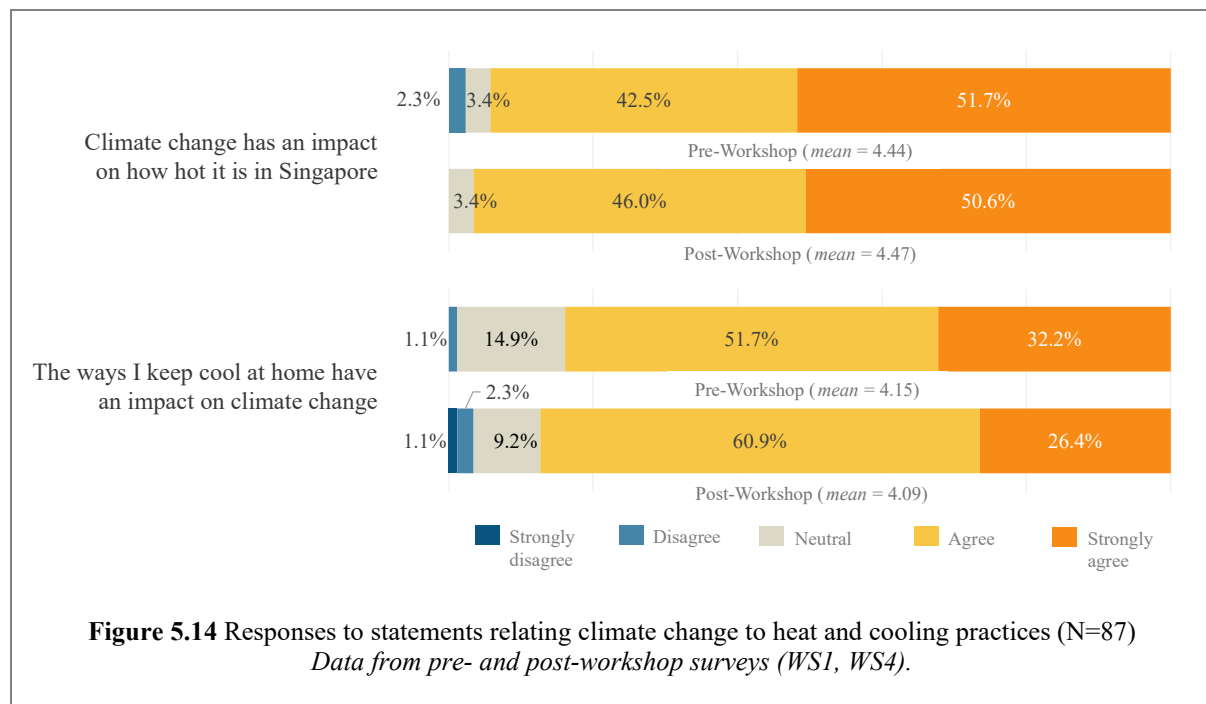


Figure 5.13 Perceptions of Singapore's contribution to climate change (N=87)
 Correct responses are underlined. Data from pre- and post-workshop surveys (WS1, WS4).

5.3.4 Recognising the impacts of cooling choices on climate change

Participants showed consistent agreement that climate change has an impact on how hot it is in Singapore with the mean edging up slightly post-workshop (from 4.44 to 4.47). The distribution remained dominated by agree/strongly agree (over 96% combined at both timepoints), indicating a strong, stable consensus that climate change manifests locally as heat. This complements earlier increases in concern and the decline in the belief that Singapore is “relatively safe”. Together, these results show that participants now anchor climate change in local experience rather than treating it as distant or abstract.

As for the statement “The ways I keep cool at home have an impact on climate change”, the pattern is more nuanced. Neutral responses fell (14.9% to 9.2%), agreement rose (51.7% to 60.9%) while strong agreement dipped (32.2% to 26.4%), yielding a slight mean decrease (4.15 to 4.09). Interpreted alongside the workshop’s content, this shift suggests participants moved from unqualified conviction to a more calibrated understanding: they still broadly accept the causal link between cooling choices and emissions, but now differentiate which practices matter most (e.g., air-conditioning set-points, runtime, maintenance versus fans and natural ventilation). In other words, recognition of their impact increased (less neutrality, more agreement), but certainty softened (fewer “strongly agree”) as participants incorporated technical nuance.



5.3.5 Receptiveness to climate inaction justifications

Participants were asked before and after the workshop to rate how weakly or strongly they considered several common reasons that people tend to cite for not acting on climate change. Across all five statements reflecting justifications for climate inaction, acceptance declined post-workshop (Figure 5.15), indicating reduced endorsement of such explanations. The largest shifts were observed for individual efficacy/fatalism and information confusion, with notable declines in spatial- and temporal-related reasoning, and a reduction in externalising responsibility.

The workshop’s urban heat framing made local risk salient, as reflected in the reduced mean from 2.44 to 2.31 to the statement about Singapore’s relative safety from extreme weather events.

Fatalism also decreased as the mean endorsement to the statement that “climate change was too big and complicated for individuals to solve” fell from 3.13 to 2.83. Consistent with the increases observed in knowledge, confidence, and intentions to act, this finding suggests participants left with domain-specific agency that increased critical engagement.

Resting on the future-oriented impacts of climate change as a justification also declined. Responding to the statement “The most severe impacts will only occur decades from now, when I may no longer be around,” the mean decreased moderately from 2.82 to 2.64, corroborating how participants increasingly recognised present local heat and its everyday implications on health, productivity, and bills.

Additionally, participants externalised responsibility less. While they still expected system actors to lead, they increasingly acknowledge a shared responsibility as seen in their response to the statement “Climate change is mainly caused by big developed countries and large corporations; it is their responsibility to resolve it” whereby mean decreased from 3.01 to 2.87.

Finally, the reduction in mean from 2.92 to 2.54 to the statement “I hear so many different things about climate change that it is difficult to make sense of it” also suggests information confusion decreased, which could be attributed to how the workshop’s structured content and hands-on mapping offered clear heuristics (e.g., cross-ventilation, stack effect, night-purge), improved epistemic clarity and helped participants connect cooling practices to climate outcomes.

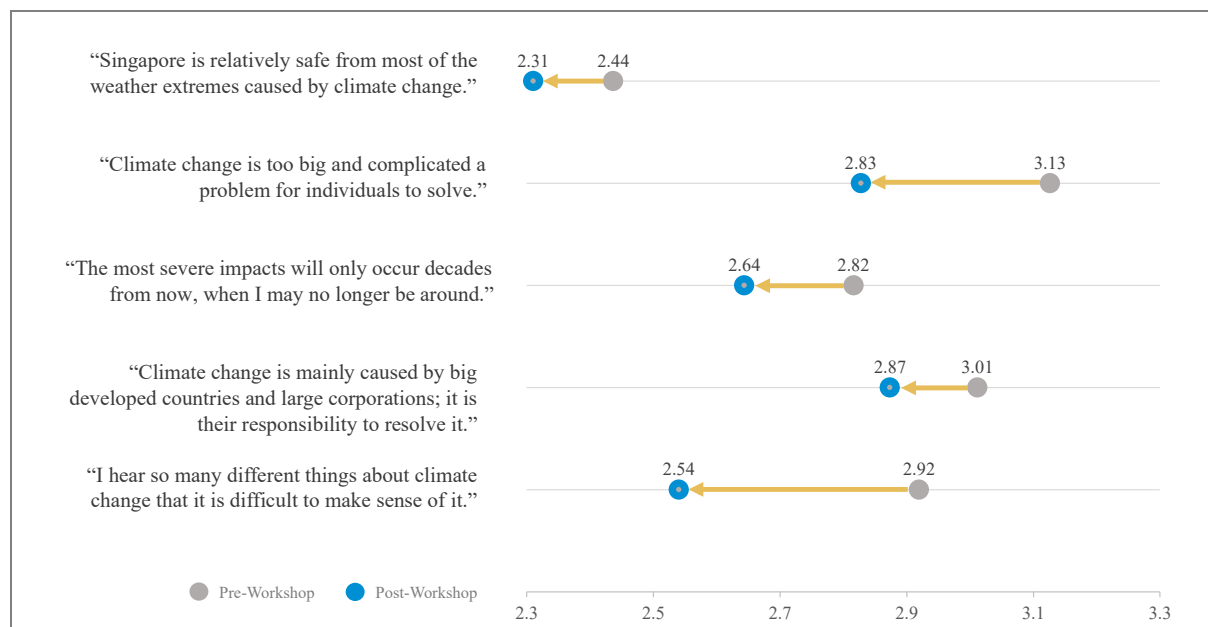
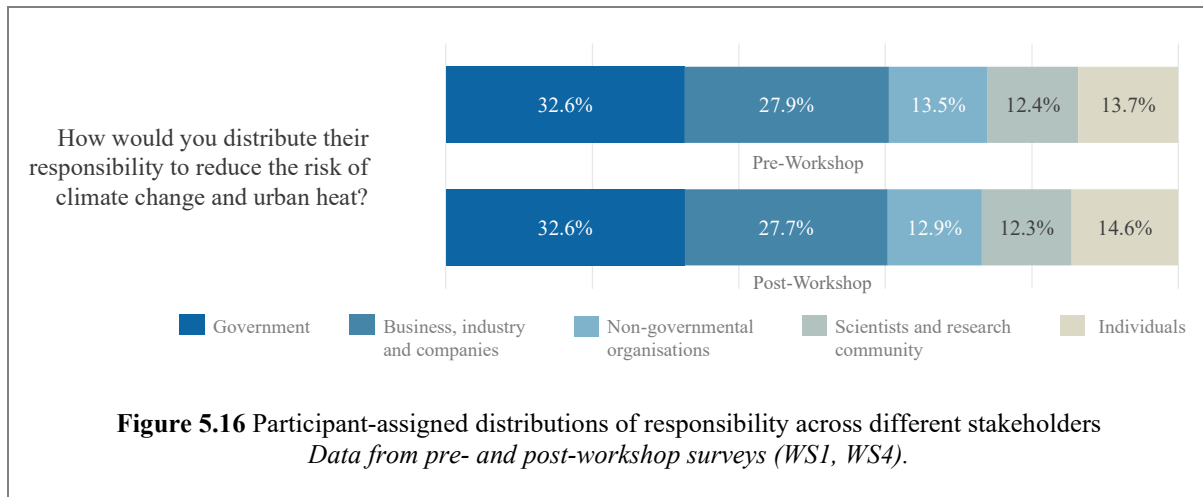


Figure 5.15 Shifts in receptiveness to climate inaction justifications (N=87)
 Using a 5-point Likert scale (1=Very Weak, 5=Very Strong).
 Data from pre- and post-workshop surveys (WS1, WS4).

5.4 Responsibility Attribution Across Stakeholders

Participants attributed primary climate responsibility to the government. This conviction remained stable pre- and post-workshop, with business and industry seen as a secondary actor. This points to structural barriers where individual actions and adaptation efforts are perceived as contingent on broader systemic change and policy leadership. Put differently, it indicates the hold of scalar disconnect: where at the individual scale, both the relative responsibility towards climate change as well as the effectiveness of actions are heavily discounted.





Chapter 6

Discussion and Pathways Forward

6. Discussion and Pathways Forward

6.1 Synthesis of Key Findings

Taken together, the results show how residents already navigate heat through practical routines and how a targeted, dialogue-based intervention can shift understanding and readiness to act.

Baseline observations: Participants already recognised heat as closely linked to climate change, yet heat management remained largely reactive, oriented toward immediate comfort rather than anticipatory or long-term planning. Everyday cooling practices were dominated by mechanical strategies, including near-ubiquitous fan use and a range of air-conditioning behaviours from high night-time usage to adaptive hybrid cooling. Non-mechanical practices such as cooling attire, cold showers, and occasional natural ventilation were also common, though sensory and environmental barriers limited optimal ventilation. Cooling decisions were shaped primarily by cost and health considerations. While participants expressed only moderate confidence in their existing practices, they demonstrated strong openness to learning, signalling readiness to adopt new approaches.

Workshop effects: The workshop built on this foundation and contributed to several meaningful shifts. Participants reported greater behavioural openness to heat adaptation, including increased willingness to use methods beyond air-conditioning and stronger personal motivation to tolerate heat. Their understanding of cooling co-benefits broadened beyond cost-saving to include health, mental well-being, and intergenerational impacts. Knowledge gains were most evident in domains emphasised during the workshop, particularly how physical design and airflow influence indoor temperatures. At the same time, cost and health remained stable as the primary motivations guiding cooling decisions, suggesting that while participants recognised a wider range of benefits, the underlying drivers of decision-making remained consistent.

Shifts in broader climate-related perceptions were more selective. Participants expressed greater concern about climate change and reduced spatial distance, with fewer perceiving Singapore as insulated from risk. Temporal and social distance, however, remained largely unchanged. While general perceptions of individual climate agency only showed minor improvements, confidence in the effectiveness of participants' own sustainable cooling behaviours increased, suggesting a clearer sense of what individuals can meaningfully do within the domain of heat management even as broader climate action continued to feel system dependent.

Finally, participants consistently attributed primary responsibility for addressing climate change to the government, with business and industry viewed as secondary actors. This stable pattern reflects a persistent scalar disconnect, in which individual responsibility and perceived action efficacy are discounted relative to system-level leadership. This underscores the importance of situating sustainable cooling not only within personal behaviour change but also within broader regulatory and infrastructural contexts.

Together, these findings highlight both the potential and limitations of dialogue-based interventions. They can expand understanding, strengthen motivation, and help participants refine personal strategies. Perceptions of systemic responsibility and deeper dimensions of psychological distance, however, remain more resistant to change.

6.2 Support and Enablers for Action

The workshop findings point to two key gaps. First, residents are willing to act but practical constraints that are not always related to costs (sensory/environmental barriers, privacy concerns, structural features) limit what can be realistically done. Second, awareness and knowledge are present but not fully calibrated to support sustained and optimised action, as seen in mixed understanding of cooling impacts and underestimation of collective efforts. The enablers proposed below address these gaps and draw on insights from workshop discussions, observations and findings from earlier work groups.

At the household level, some practical and immediate enablers can include:

1. **Practical learning materials:** simple, illustrated guidance for cross-ventilation, night-purge, room zoning, appliance heat management, air-conditioning timer usage, hybrid cooling, shading, layout and routine optimisation. These materials could take the form of a playbook or micro-curriculum through short modules, turning key cooling concepts into step-by-step routines.
2. **Mitigating non-cost frictions** such as:
 - a. Insects/air pollution/noise/odours by using fine-mesh screens, filtered trickle vents, acoustic seals, odour baffles.
 - b. Privacy by using secure grilles, louvres/baffles to allow airflow without compromising privacy.
3. **Subsidies for shading devices:** participants already report using shading apparatuses such as window films but some suggested for the costs to be alleviated through some form of subsidy.

At the community or building level, some visible collective efficacy can look like:

1. **Community spaces as support for decluttering:** decluttering can reduce solar gain and improve airflow. Participants noted that such efforts could be better supported through shared storage spaces or community storerooms (to reduce the need to keep rarely used items at home). Digital platforms for loaning items to fellow block residents was also suggested.
2. **Ventilation-friendly common spaces:** ventilated shared rooms can demonstrate block-level cooling and provide relief where home ventilation is constrained. Participants noted that they already seek cooled environments outside the home such as malls or libraries to reduce cooling costs. Several also suggested that void decks could be adapted into functional cooling community spaces beyond “just a passageway to get home.”
3. **Peer diffusion:** resident champions and micro-sessions that share workshop know-how, leverage the high intention to teach others (see Figure 5.10).

At the policy level, enablers that can bring scale and equity can include:

1. **Targeted incentives:** vouchers or rebates could support a wider range of cooling-related improvements reflected in items already commonly used by participants (e.g. window films, shading equipment like blinds, and other cooling-related home improvements). Participants expressed appreciation for Climate Vouchers given under the Enhanced Climate Friendly Households Programme (CFHP), for example, but noted the scheme’s limited coverage.
2. **Micro-retrofit facilitation:** streamlined approvals for low-risk ventilation or shading retrofits to reduce transaction friction. Some participants cited fear of accidentally flouting HDB rules as a barrier to implementing cooling-related changes to their physical environment.

6.3 Pathways Forward for Citizen Engagement on Climate Change and Urban Heat

Beyond practical supports, the workshop also provides broader lessons for designing citizen engagement initiatives on climate change and heat that are grounded in lived experiences.

Citizen dialogue as a learning platform: The workshop demonstrates that dialogue formats combining scientific knowledge transfer (in this case, related to climate and cooling) with discussion of lived constraints can reduce spatial distance, boost climate concern, and build domain-specific agency. Embedding hands-on mapping also translate abstract concepts into embodied understanding. Moving forward, efforts to engage residents should tap into structured dialogue sessions that integrate with practical elements to ensure participants connect scientific insights with their own lived realities.

Message framing that resonates and sustains relevance: Framing messages around cost and health as universal anchors, while layering comfort and intergenerational benefits, proved effective in sustaining relevance. Precision in information that is offered can help to avoid misperceptions and build trust.

Building everyday adaptive capacity: The interest in passive cooling techniques highlights a demand for practical and context-specific skills. Engagement efforts should therefore go beyond messaging and include simple, hands-on demonstrations that residents can immediately try at home. This will ensure that residents leave with actionable techniques, not just take-home messages.

Supporting community-based and ground-up initiatives: Participants expressed strong interest in community-led initiatives. A promising vehicle for this involves resident-led cooling clubs promoted by “block ambassadors” who organise short “cooling clinics” to share practical tips and build social norms around their adoption. Partnerships with local councils to pilot cooling-friendly community spaces can further amplify impact and visibility.

In summary, the dialogue made climate change locally salient and equipped participants with practical cooling knowledge to catalyse intentions to act. The next challenge lies in translating these intentions into sustained behaviour. Achieving this will require pairing household-level guidance with community support and enabling policy frameworks.

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Supplementary Material

Table S1 summarises all measurable constructs grouped by worksheets, detailing theoretical sources, item numbers, and measurement scales for each variable. It serves as a complete reference for all data used in subsequent analyses.

Construct	Theoretical Source	Count	Scale Type
Worksheet 1			
Workshop Motivation	Adapted from CRC WG1 and Chng et al. (2021)	3	Multiple Options (Ordinal, Categorical)
Perspectives on Climate Change	Adapted from CRC WG1	14	5-Point Likert
Sustainable Cooling Attitudes	Adapted from Hamann et al., 2023; Hamann et al., 2020; Joanes, 2019; Thogersen et al., 2010	9	Multiple Options (5-Point Likert, Text Response)
Air-Conditioning Usage	Adapted from CRC WG1	9	Multiple Options (Discrete, Binary, 5-Point Likert)
Perceived Knowledge	Self-Developed & Adapted from Novel Food	5	5-Point Likert
Climate Change and Heat in Singapore	Self-Developed	5	Categorical
Collective Trust & Responsibility	CAST, 2024; Cologna et al., 2020	5	Continuous
Worksheet 2			
Cooling Strategies & Understanding of Airflow and Ventilation	Adapted from CRC WG1	4	5-Point Likert
Relationship with Heat	Self-Developed	6	5-Point Likert
Cooling Motivations	Self-Developed	5	5-Point Likert
Worksheet 3			
Re-evaluation of Past Cooling Strategies	Self-Developed	4	5-Point Likert
Intentions for Future Actions	Self-Developed	4	5-Point Likert
Usefulness and Applicability of Educational Materials	Self-Developed	4	Multiple Options (5-Point Likert, Text Response)
Worksheet 4			
Sustainable Cooling Attitudes	Adapted from Hamann et al., 2023; Hamann et al., 2020; Joanes, 2019; Thogersen et al., 2010	15	Multiple Options (5-Point Likert, Text Response)
Perspectives on Climate Change	Adapted from CRC WG1	14	5-Point Likert
Perceived Knowledge	Self-Developed & Adapted from Novel Food	5	5-Point Likert
Climate Change and Heat in Singapore	Self-Developed	5	Categorical
Collective Trust & Responsibility	CAST, 2024; Cologna et al., 2020	5	Continuous

Worksheet 1

Workshop Motivations

1/ Have you ever participated in a citizens' dialogue, citizens' debate, or public workshop before today?

- No Yes, once or twice Yes, three or more times

2/ How did you get to the workshop today? Select all that apply.

- Public transport Cycle Walk Private hire (taxi) Personal vehicle (car, motorcycle)

Others: _____

3/ What motivated you to attend this workshop? Select all that apply.

- To learn more about climate change.
 To learn more about the causes and impacts of heat in Singapore.
 To learn effective ways to keep my home cooler and more comfortable.
 To learn how to manage heat in a more environmentally sustainable way.
 To contribute my views to discussions on climate and heat.
 To meet and exchange with other residents, regardless of topic.
 To earn the \$80 incentive.
 Others: _____

Worksheet 1 (continued)

Perspectives on Climate Change

1/ How concerned are you about climate change?

- Not concerned at all
 Somewhat concerned
 Moderately concerned
 Concerned
 Very concerned

Statements	Rating Scales				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2/ "Climate change has an impact on how hot it is in Singapore."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3/ "The ways I choose to keep cool at home have an impact on climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4/ "I feel responsible for the environmental impact of my personal choices."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5/ "Climate change will impact future generations more than the current generation."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6/ "Singapore is relatively safe from climate change compared to other countries."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7/ "I can relate to victims of climate-related disasters."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8/ "My personal actions can help reduce climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9/ "The science about climate change is far from settled."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10/ Some people in Singapore say that they do not take action on climate change, and they give the following reasons to justify their stance.

How strong or weak do you find each reason?

Reasons	Rating Scales				
	Very weak	Weak	Neutral	Strong	Very strong
a. "Singapore is relatively safe from most of the weather extremes caused by climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. "Climate change is too big and complicated a problem for individuals to solve."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. "The most severe impacts will only occur decades from now, when I may no longer be around."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. "Climate change is mainly caused by big developed countries and large corporations; it is their responsibility to resolve it."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. "I hear so many different things about climate change that it is difficult to make sense of it."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Worksheet 1 (continued)

Sustainable Cooling Attitudes

1/ To what extent do you think sustainable cooling practices* at home can bring benefits beyond helping the environment?

**Sustainable cooling practices refer to strategies to maintain thermal comfort while minimising environmental impact. They can include behavioural adjustments, adjustments to one's environment, efficient use of cooling devices, etc.*

- Not at all
 Little
 Somewhat
 Much
 A great deal

2/ Suggest at least one other benefit (unrelated to helping the environment) of adopting sustainable cooling practices.

Answer:

3/ How strongly do you agree with the following statements:

Rating Scales

Strongly Disagree Disagree Neutral Agree Strongly Agree

a. "I am willing to rely on methods other than air-conditioning to stay cool at home."

b. "I already do rely heavily on methods other than air-conditioning to stay cool at home."

c. "I feel like methods other than air-conditioning could successfully keep me cool at home."

d. "Most people in Singapore are willing to rely on methods other than air-conditioning to stay cool at home."

e. "Most people in Singapore already rely heavily on methods other than air-conditioning to stay cool at home."

f. "By adopting sustainable ways of keeping cool at home, I would be contributing to solving the climate crisis."

g. "If people in Singapore adopt sustainable cooling practices together, we can make a meaningful difference for the environment."

Worksheet 1 (continued)

Air-Conditioning Usage

1/ On a typical day, how many hours do you spend in an air-conditioned place?

Answer: _____

2/ On a typical day, how many hours do you spend outdoors (i.e., not in enclosed environments)?

Answer: _____

3/ Do you have air-conditioning at home?
If yes, what temperature is your air-conditioner set to most of the time?

Yes No

Temperature: _____

4/ How often do you do the following to keep cool at home:

(Mark "N/A" if you don't have air-conditioning at home)

Rating Scales

N/A Never Rarely Sometimes Often Always

a. Use air-conditioning when awake?

b. Use air-conditioning when sleeping?

5/ When using air-conditioning, how often do you:

(Mark "N/A" if you don't have air-conditioning at home)

Rating Scales

N/A Never Rarely Sometimes Often Always

a. Use it in combination with an electric fan?

b. Leave the windows or door open?

c. Set a timer?

d. Actively change the temperature?

Worksheet 1 (continued)

Perceived Knowledge

What is your current level of understanding about each of the following topics?

1/ Climate change

- No understanding:** I have never heard of the term, or I have heard about climate change but don't really know what it means.
- Basic understanding:** I know some general facts about climate change but not in detail.
- Moderate understanding:** I understand the main causes and impacts of climate change.
- Good understanding:** I'm familiar with various aspects of climate change, including its science and effects.
- Advanced understanding:** I have in-depth knowledge of climate change and its impacts.

2/ Urban heat island

- No understanding:** I have never heard of the term, or I have heard about "urban heat island" but don't really know what it means.
- Basic understanding:** I know some general facts about "urban heat island" but not in detail.
- Moderate understanding:** I know some aspects of how "urban heat island" occur.
- Good understanding:** I understand quite a lot about the consequences and ways to address "urban heat island".
- Advanced understanding:** I have in-depth knowledge about "urban heat island" and strategies to mitigate it.

3/ Connection between climate change and heat in Singapore

- No understanding:** I have little to no knowledge about the link between climate change and heat in Singapore.
- Basic understanding:** I know that climate change and heat are linked, but not the details.
- Moderate understanding:** I know various aspects of how climate change and heat are linked in Singapore.
- Good understanding:** I understand how climate change and heat interact in Singapore's context, including some aspects of mitigation and adaptation strategies.
- Advanced understanding:** I have in-depth knowledge about the relationship between climate change and heat in Singapore, and how mitigation and adaptation strategies are part of this relationship.

4/ Cooling practices and the body

- No understanding:** I have little to no knowledge about cooling practices.
- Basic understanding:** I know a bit about what can be done to keep cool.
- Moderate understanding:** I know some ways of how cooling practices affect the body.
- Good understanding:** I understand which cooling practices tend to work and which may not work well.
- Advanced understanding:** I have in-depth knowledge about cooling practices and their effects on the body.

5/ Influence of physical design on airflow and temperature

- No understanding:** I have little to no knowledge about physical design, airflow and temperature.
- Basic understanding:** I know that physical design influences airflow and temperature, but not the details.
- Moderate understanding:** I know some aspects of how physical design can affect airflow and temperature.
- Good understanding:** I understand how physical design influences airflow and temperature in spaces.
- Advanced understanding:** I have in-depth knowledge about physical design and its effects on airflow and temperature.

Worksheet 1 (continued)

Climate Change and Heat in Singapore

1/ Do you feel that Singapore has become hotter over the years? How fast do you think Singapore warmed compared to the global average over the last half century?

- 2x slower About the same rate 2x faster 5x faster I don't know

2/ When it comes to the negative impact of everyday actions on climate change, how does a typical person in Singapore compare to the global average?

- About 5x the global average About 2x the global average About the same as global average About half the global average I don't know

3/ Air-conditioning is a big part of life here. If you raise the AC temperature by just 1°C, how much electricity do you think you could save?

- Less than 2% Between 2-5% Between 5-7% Between 7-10% I don't know

4/ Air-conditioning keeps us cool indoors, but it also affects the outdoors. Based on Singapore's typical air-conditioning usage, how much hotter do you think it makes our city's air temperature?

- Between 1-2°C Between 2-3°C Between 3-4°C Between 4-5°C I don't know

5/ If the world continues business as usual and does not reduce our climate impact ("high emissions pathway"), Singapore will experience annually how many days of high heat stress (above 33°C)* by 2080-2099?

**Based on daily mean wet bulb globe temperature (WBGT)*

- Every single day Up to 326 days Up to 126 days Up to 26 days I don't know

Collective Trust & Responsibility

If you were to assign a percentage of responsibility to each of the following groups in Singapore, how would you distribute their responsibility to reduce the risk of climate change and urban heat?

The total must add up to 100%.

- (a) Government: _____ %
(b) Business, industry, and companies: _____ %
(c) NGOs (e.g. environmental groups): _____ %
(d) Scientists and research community: _____ %
(e) Individuals: _____ %

----- End of WS1 -----

Worksheet 2

Cooling Strategies & Understanding of Airflow and Ventilation

1/ How effective do you think your cooling practices at home are?

- Not at all effective
 Slightly effective
 Moderately effective
 Effective
 Extremely effective

2/ To what extent do you feel that you know all the possible ways to keep cool at home?

- I know very little and there are many that I don't know about.
 I know a few useful ways but there are still many others.
 I know some useful ways, but there could be some others.
 I know most of the useful ways.
 I already know every useful way.

3/ How well do you think you understand how airflow and ventilation can help cool your home?

- Not at all
 Somewhat
 Moderately
 Well
 Extremely well

4/ How open are you to learning new ways to cope with heat at home?

- Not open at all
 Slightly open
 Moderately open
 Open
 Extremely open

Relationship with Heat

How strongly do you agree with the following statements:

Rating Scales

Strongly Disagree Disagree Neutral Agree Strongly Agree

a. "I usually stick to my original plans, even if it is hot."

-

b. "I often check the weather forecast to know how hot it will be for the day."

-

c. "Heat shapes my daily routines to a great extent."

-

d. "Heat was a factor in how I designed my room."

-

e. "I dislike sweating and will avoid it at all costs."

-

f. "I want to be more tolerant of heat."

-

Worksheet 2 (continued)

Cooling Motivations

<i>I choose my cooling practice(s) at home based on:</i>	<i>Rating Scales</i>				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. How much money it costs me to keep cool	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. How healthy it is for me in the long run	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. How sustainable it is for the environment	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. How much it affects other people in the room	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. How much it affects other people in Singapore	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

----- **End of WS2** -----

Worksheet 3

Re-evaluation of Past Cooling Strategies

1/ After going through the lectures and activities, how effective do you think your current cooling practices at home actually are?

- Not at all effective
 Slightly effective
 Moderately effective
 Effective
 Extremely effective

2/ After going through the lectures and activities, how much do you feel you actually knew about ways to keep cool at home before?

- I know very little and there are many that I don't know about.
 I know a few useful ways but there are still many others.
 I know some useful ways, but there could be some others.
 I know most of the useful ways.
 I already know every useful way.

3/ After going through the lectures and activities, how well do you think you actually understood airflow and ventilation before?

- Not at all
 Somewhat
 Moderately
 Well
 Extremely well

4/ Do you feel better equipped to deal with heat at home now compared to before today?

- Not at all
 Not really
 Neutral
 Somewhat
 Definitely

Intentions for Future Actions

Rating Scales

After this workshop, do you plan to:

Definitely not Probably not Not sure Probably Definitely

	Definitely not	Probably not	Not sure	Probably	Definitely
a. Try any new behavioural cooling strategies at home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. Try any new airflow or ventilation strategies at home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. Discuss with your household members about how to improve the thermal conditions at home?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. Share what you have learned about cooling with others?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Worksheet 3 (continued)

Usefulness and Applicability of Educational Materials

1/ How easy was it to apply the knowledge shared in the presentations when re-mapping your home?

- Not at all easy Somewhat easy Moderately easy Easy Extremely easy

2/ What is the one change you are most likely to try after today?

Answer:

3/ What is the biggest barrier that will prevent you from making any changes?

Answer:

4/ What support (e.g., tools, resource) would help you the most when it comes to improving the thermal conditions in your home?

Answer:

----- End of WS3 -----

Worksheet 4

Sustainable Cooling Attitudes

1/ To what extent do you think sustainable cooling practices* at home can bring benefits beyond helping the environment?

**Sustainable cooling practices refer to strategies to maintain thermal comfort while minimising environmental impact. They can include behavioural adjustments, adjustments to one's environment, efficient use of cooling devices, etc.*

- Not at all
 Little
 Somewhat
 Much
 A great deal

2/ Rate the importance of each of the following benefits in your decision to adopt sustainable cooling practices at home:

Rating Scales

Not at all important Somewhat important Moderately Important Important Extremely important

a. Cost savings

b. Health promotion

c. Environmental protection

d. How much it helps other people at home

e. How much it helps other people in Singapore

3/ What other benefits are important for you?

Answer:

Worksheet 4 (continued)

4/ <i>How strongly do you agree with the following statements:</i>	<i>Rating Scales</i>				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. "I am willing to rely on methods other than air-conditioning to stay cool at home."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. "I already do rely heavily on methods other than air-conditioning to stay cool at home."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. "I feel like methods other than air-conditioning could successfully keep me cool at home."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. "Most people in Singapore are willing to rely on methods other than air-conditioning to stay cool at home."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. "Most people in Singapore already rely heavily on methods other than air-conditioning to stay cool at home."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
f. "By adopting sustainable ways of keeping cool at home, I would be contributing to solving the climate crisis."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
g. "If people in Singapore adopt sustainable cooling practices together, we can make a meaningful difference for the environment."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
h. "I want to be more tolerant of heat."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Worksheet 4 (continued)

Perspectives on Climate Change

1/ How concerned are you about climate change?

- Not concerned at all
 Somewhat concerned
 Moderately concerned
 Concerned
 Very concerned

Statements	Rating Scales				
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
2/ "Climate change has an impact on how hot it is in Singapore."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3/ "The ways I choose to keep cool at home have an impact on climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4/ "I feel responsible for the environmental impact of my personal choices."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5/ "Climate change will impact future generations more than the current generation."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6/ "Singapore is relatively safe from climate change compared to other countries."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7/ "I can relate to victims of climate-related disasters."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8/ "My personal actions can help reduce climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9/ "The science about climate change is far from settled."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10/ *Some people in Singapore say that they do not take action on climate change, and they give the following reasons to justify their stance.*

How strong or weak do you find each reason?

Reasons	Rating Scales				
	Very weak	Weak	Neutral	Strong	Very strong
a. "Singapore is relatively safe from most of the weather extremes caused by climate change."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
b. "Climate change is too big and complicated a problem for individuals to solve."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
c. "The most severe impacts will only occur decades from now, when I may no longer be around."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
d. "Climate change is mainly caused by big developed countries and large corporations; it is their responsibility to resolve it."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
e. "I hear so many different things about climate change that it is difficult to make sense of it."	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Worksheet 4 (continued)

Perceived Knowledge

What is your current level of understanding about each of the following topics?

1/ Climate change

- No understanding:** I have never heard of the term, or I have heard about climate change but don't really know what it means.
- Basic understanding:** I know some general facts about climate change but not in detail.
- Moderate understanding:** I understand the main causes and impacts of climate change.
- Good understanding:** I'm familiar with various aspects of climate change, including its science and effects.
- Advanced understanding:** I have in-depth knowledge of climate change and its impacts.

2/ Urban heat island

- No understanding:** I have never heard of the term, or I have heard about "urban heat island" but don't really know what it means.
- Basic understanding:** I know some general facts about "urban heat island" but not in detail.
- Moderate understanding:** I know some aspects of how "urban heat island" occur.
- Good understanding:** I understand quite a lot about the consequences and ways to address "urban heat island".
- Advanced understanding:** I have in-depth knowledge about "urban heat island" and strategies to mitigate it.

3/ Connection between climate change and heat in Singapore

- No understanding:** I have little to no knowledge about the link between climate change and heat in Singapore.
- Basic understanding:** I know that climate change and heat are linked, but not the details.
- Moderate understanding:** I know various aspects of how climate change and heat are linked in Singapore
- Good understanding:** I understand how climate change and heat interact in Singapore's context, including some aspects of mitigation and adaptation strategies.
- Advanced understanding:** I have in-depth knowledge about the relationship between climate change and heat in Singapore, and how mitigation and adaptation strategies are part of this relationship.

4/ Cooling practices and the body

- No understanding:** I have little to no knowledge about cooling practices.
- Basic understanding:** I know a bit about what can be done to keep cool.
- Moderate understanding:** I know some ways of how cooling practices affect the body.
- Good understanding:** I understand which cooling practices tend to work and which may not work well.
- Advanced understanding:** I have in-depth knowledge about cooling practices and their effects on the body.

5/ Influence of physical design on airflow and temperature

- No understanding:** I have little to no knowledge about physical design, airflow and temperature.
- Basic understanding:** I know that physical design influences airflow and temperature, but not the details.
- Moderate understanding:** I know some aspects of how physical design can affect airflow and temperature.
- Good understanding:** I understand how physical design influences airflow and temperature in spaces.
- Advanced understanding:** I have in-depth knowledge about physical design and its effects on airflow and temperature.

Worksheet 4 (continued)

Climate Change and Heat in Singapore

1/ Do you feel that Singapore has become hotter over the years? How fast do you think Singapore warmed compared to the global average over the last half century?

- 2x slower
 About the same rate
 2x faster
 5x faster
 I don't know

2/ When it comes to the negative impact of everyday actions on climate change, how does a typical person in Singapore compare to the global average?

- About 5x the global average
 About 2x the global average
 About the same as global average
 About half the global average
 I don't know

3/ Air-conditioning is a big part of life here. If you raise the AC temperature by just 1°C, how much electricity do you think you could save?

- Less than 2%
 Between 2-5%
 Between 5-7%
 Between 7-10%
 I don't know

4/ Air-conditioning keeps us cool indoors, but it also affects the outdoors. Based on Singapore's typical air-conditioning usage, how much hotter do you think it makes our city's air temperature?

- Between 1-2°C
 Between 2-3°C
 Between 3-4°C
 Between 4-5°C
 I don't know

5/ If the world continues business as usual and does not reduce our climate impact ("high emissions pathway"), Singapore will experience annually how many days of high heat stress (above 33°C)* by 2080-2099?

**Based on daily mean wet bulb globe temperature (WBGT)*

- Every single day
 Up to 326 days
 Up to 126 days
 Up to 26 days
 I don't know

Collective Trust & Responsibility

If you were to assign a percentage of responsibility to each of the following groups in Singapore, how would you distribute their responsibility to reduce the risk of climate change and urban heat?

The total must add up to 100%.

- (a) Government: _____ %
 (b) Business, industry, and companies: _____ %
 (c) NGOs (e.g. environmental groups): _____ %
 (d) Scientists and research community: _____ %
 (e) Individuals: _____ %

