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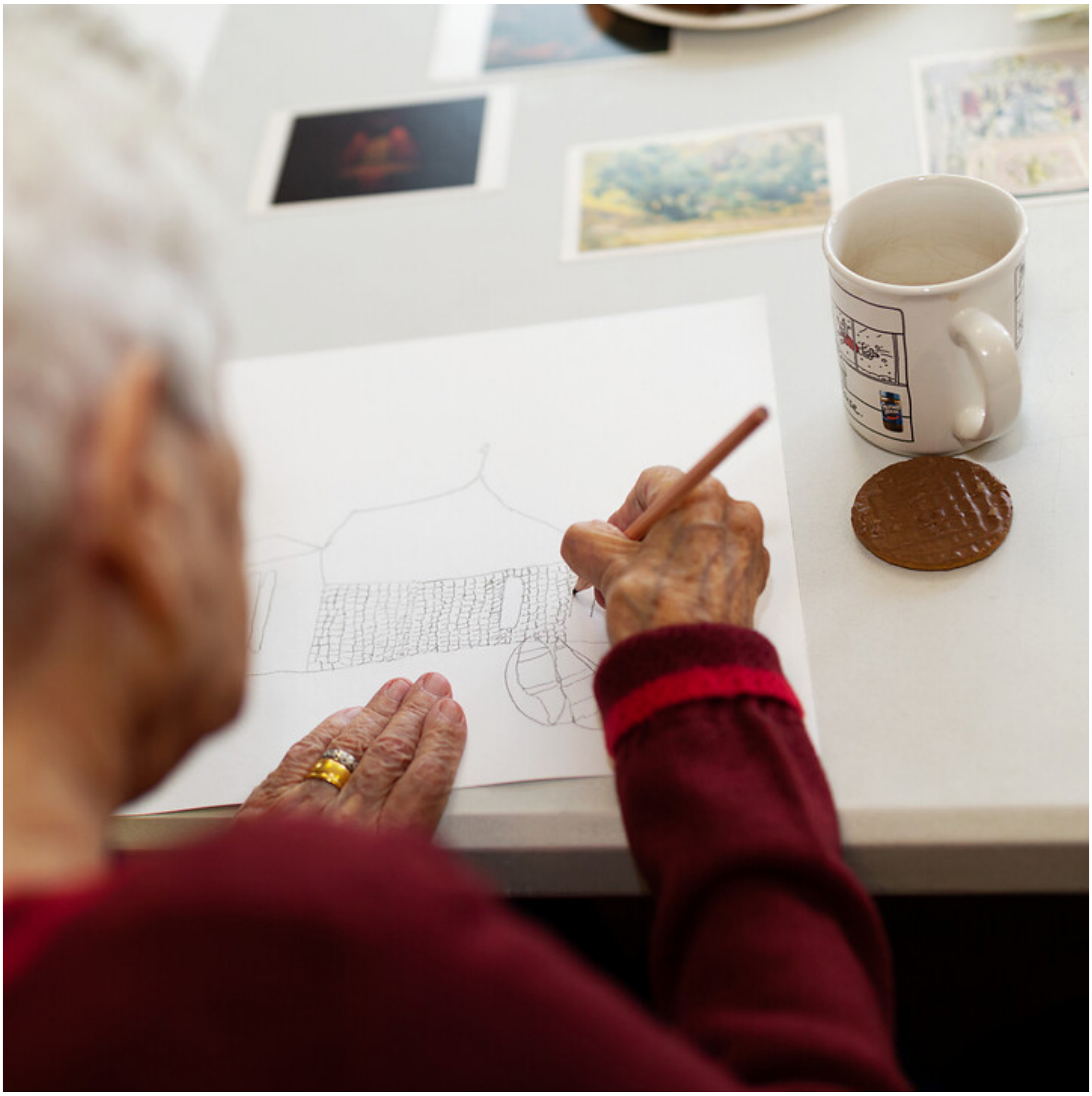

Care Home Overheating Audit Pilot Project

Executive Summary

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Executive Summary

Summary

Following the 2003 heatwave that resulted in over 600 excess deaths across London, studies showed that the older population residing in care homes are at the highest risk of heat-related premature death [1]. The Greater London Authority (GLA) is concerned about the impacts of heat on older people. This is because older people, especially those who are frail, have chronic medical conditions and a limited ability to adapt their behaviours and/or environments quickly to stay cool are less able to cope with higher temperatures. This is why in the autumn of 2018, the GLA commissioned researchers from University College London (UCL) and Oxford Brookes University (OBU) to pilot an audit process to produce evidence-based recommendations for reducing the occurrence of summertime indoor overheating and exposure to elevated temperatures in care settings by residents, as well as an easy-to-use Best Practice Overheating Checklist.

The audit results and findings aim to provide consideration by the Care Quality Commission (CQC) to include the risk of overheating due to the impact of climate change in their inspection assessment of care homes. The assessment process is aimed at care home leaders, managers and staff; and could be used to inform decision-making on overheating adaptations by a care home.

This case study involves an audit of the overheating in care homes, the findings of which will support the aspirations in the Mayor’s London Environment Strategy (LES), specifically in relation to the resilience of critical infrastructure and their occupants, in the context of London’s changing climate. It provides: (a) a **methodology report** detailing the evidence-based approach taken to inform the recommendations for indoor and outdoor interventions, activities and initiatives to reduce indoor overheating in one care home and so mitigate residents’ exposure to heat, (b) a **recommendations’ report** dealing with the factors contributing to heat exposure in the pilot care home and the recommendation and prioritisation process and (c) an **overheating checklist,** produced in consultation with Public Health England (PHE), and designed to offer care homes for older residents a 16-point action plan that can be implemented to reduce the indoor overheating exposure of vulnerable residents.

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[1] Holstein, J., Canoui-Poitrine, F., Neumann, A., Lepage, E. & Spira, A. Were less disabled patients the most affected by 2003 heat wave in nursing homes in Paris, France? *J. Public Health (Bangkok).* **27**, 359–365 (2005); Hajat, S., Kovats, R. S. & Lachowycz, K. Heat-related and cold-related deaths in England and Wales: who is at risk? *Occup. Environ. Med.* **64**, 93–100 (2007); Kovats, R. S., Johnson, H. & Griffith, C. Mortality in southern England during the 2003 heat wave by place of death. *Heal. Stat. Q.* 6–8 (2006).

Overall findings, recommendations and lessons learnt

The UK Government's 2050 net zero target highlights the need to create climate resilient indoor environments whilst the outbreak of COVID-19 has emphasised the necessity to protect those most at need.

This audit was used as a basis for the development of a standardised audit process that will assist the overheating risk mitigation for older people residing in care home settings. The findings indicate that even though passive solutions alone may not be adequate for maintaining a safe and comfortable environment under the future warming climate, care homes investing in adaptation measures are expected to remain comfortable for longer and rely less on mechanical cooling. Care homes could benefit from simple measures incurring minimal or no cost at all, such as switching off unnecessary heat sources and applying rules for window opening and use of curtains, to highly efficient albeit more complex and expensive solutions that could be implemented in the longer term. These include the application of external shading, high albedo finishing materials and green roofs. Among all these, minimising internal heat gains is suggested as the first course of action.

A sample list ranking overheating reduction measures and their impacts based on individual assessment criteria, resulting from the in-depth audit carried out as part of this pilot project, is presented in **Table 1**. This matrix formed the basis for the development of the Best Practice Overheating Checklist (included in Appendix 1 of this Executive Summary).

It is beyond the scope of this audit pilot study to report on all possible interventions and their combinations. Instead, this study presents an assessment process that could be utilised to inform decision-making on overheating adaptations. The key lessons learnt will be used to inform the establishment of a longer-term process that could be replicated in the future. These include:

- Data monitoring during the heating season can provide valuable insights when studying overheating, as heat exposure and heat related mortality can occur all year round, even when external temperatures are low.

- The all-round effectiveness of summertime overheating adaptation measures should always be considered, as improving one area may cause significant unintended consequences in other areas, including possible impacts on annual heating loads.

- Adaptation measures are best implemented at the design stage, however existing buildings can also benefit significantly from a variety of measures that can be implemented under varying timescales, budgets and other requirements.

- Occupant behaviour plays a significant role in overheating reduction and thus training care home residents and staff on how to best operate the building to keep cool is critical.

Two further projects, ClimaCare and ‘Climate Adaptation of Care Settings’, a description of which is included in Appendix 2 of this Executive Summary, will be addressing these emerging issues.

Table 1. Ranked measures and their impacts based on individual assessment criteria, grouped according to GLA's cooling hierarchy

ID	Measures	Effectiveness	Affordability	Feasibility	Disruption-free	Usability	Energy/CO² savings	Health and safety risk-free	Visual amenity	Overall score
Minimising internal heat gains										
H2	Turn off unnecessary hot water circulation	3	5	4.5	5	5	4.5	5	3	35.0
H1*	Turn off unused lighting/ equipment	3	5	5	5	4	4.5	5	3	34.5
H4*	Energy efficient lighting	3	4.5	4.5	5	5	4	5	3	34.0
H3*	Hot water pipework/ vessel insulation	4	4	4	4.5	5	4.5	5	3	34.0
Keeping the heat out										
A1	Deciduous trees for shading	4	4	3	5	5	3	5	5	34.0
C1	High albedo surfaces	4	3	3.5	4.5	5	3	5	3	31.0
J1	Curtain closed when window exposed to the sun	3	5	5	5	4	3	5	1	31.0
A2	Green roofs/walls	3	2.5	3	4	5	3	5	5	30.5
F1	Solar control window film	3	4	4	4	5	2.5	5	2	29.5
D1*	Roof/wall insulation	4	3	3	3	5	3	5	3	29.0
F2	Louvres and side fins	4.5	3.5	3	3	5	2.5	5	2	28.5
F3	Movable shutters	4.5	2.5	3	3	4	3	5	1	26.0
Managing heat										
J2	Keep windows closed when hotter outside than inside	3	5	5	5	4	3	5	3	33.0
B1	Water bodies, fountains etc.	3	2.5	3	5	5	3	4	5	30.5
G1	Thermal mass	4	3	1	1	5	3	5	3	25.0
Employing passive ventilation										
J3*	Night ventilation	4.5	5	5	5	4	3	4	3	33.5
J4*	Keep internal doors open to enable cross ventilation	4	5	5	5	4	3	4	3	33.0
E1*	Increase window openable area	4	5	5	5	4	3	1	3	30.0
E2	Cross-vent. through ducts	4	3	1	1	4	3	5	3	24.0
Using mechanical ventilation										
I1*	Free standing fans	3	4	5	5	4	2	4	3	30.0
I2	Ceiling fans	3.5	4	4	4	4	2	4	3	29.5
I3	MVHR	4	2	1	1	4	2	4	3	21.0
Deploying the lowest carbon option of active cooling										
I4	Cooled supply air	5	1	1	1	3	1	4	3	19.0

Background

The Mayor's London Environment Strategy (LES) states that impacts of extreme weather events, (including those that are heat-related), are projected to become more frequent, intense and longer-lasting, and are likely to increase existing inequalities especially for disadvantaged groups such as older people.

Of all UK regions, London presents higher overheating risks due to its geographic location and its urban heat island (UHI) effect. This leads to higher city centre temperatures compared to the surrounding rural areas. These risks are compounded when air quality is poor and can further exacerbate specific health conditions. It is vital that London's people, infrastructure and public services are better prepared for, and more resilient to, extreme heat events. To protect health and reduce health inequalities, the GLA seeks to ensure that critical infrastructure providers and occupants of homes, schools, hospitals and care homes are aware of the impacts of increased temperature and the impacts of the UHI effect.

The Committee on Climate Change and its Adaptation Sub-committee (CCC ASC) have called for heatwave climate resilience to become an integral part of the care settings inspection process. This audit pilot project builds on previous work on overheating risk in the UK care sector and adopts an interdisciplinary approach, drawing from building science and social science methods similar to those utilised in the Joseph Rowntree Foundation (JRF) funded study on 'Care provision fit for a future climate' [2], for the assessment and mitigation of overheating risks in London's care homes that are particularly sensitive to heat-related effects, through interventions, activities and behaviour change initiatives.

Aims and objectives

The overall aim of the pilot study was to develop a standardised audit process that will assist the overheating risk mitigation for older people residing in care home settings, using the selected care facility as a testing basis. The specific objectives were to:

- identify possible sources of indoor overheating;
- identify technical measures and heat management solutions to mitigate the heat exposure of the 'at risk' care home residents;
- examine the feasibility of the solutions identified, both in terms of cost and practicality of implementation in the care home setting;
- raise awareness about short- and long- term overheating consequences on the health and well-being of older care home residents through the formulation of an audit process

[2] Gupta, R. & Gregg, M. Care provision fit for a warming climate. Archit. Sci. Rev. 60, 265-285 (2017).

and the identification of behaviour change solutions and mitigation measures that could be taken up by care home managers;

- utilise project findings to develop evidence-based guidance, by producing a best practice Overheating Checklist (in consultation with PHE) suitable for dissemination within the London care home stock.

The case study

The combined research undertaken for the pilot audit of the Victoria Care Home, commissioned by the GLA and the work carried out in the same care home as part of the Natural Environment Research Council (NERC) funded ‘Climate Resilience of Care Settings (ClimaCare)’ project, provides modelled data and evidence of overheating in the care home over the summer and winter seasons.

Methodology

This audit pilot project utilises a sociotechnical and interdisciplinary approach, drawing from building science and social science methods to investigate the care home’s indoor environment over a period in the late winter/early spring 2019 and provides insights through monitoring, surveys and thermal modelling in current and future climates. The physical survey was undertaken to establish the building’s physical, technical and occupancy profile to be used as input in the dynamic thermal simulation model. Indoor temperatures, relative humidity and CO_2 concentrations were monitored in selected rooms between the 7th and the 31st March 2019 to empirically measure the indoor environment. Resident and staff surveys and interviews were undertaken to establish thermal comfort and preferences and to evaluate likely causes of over- or under- heating in the building. Dynamic thermal modelling was undertaken, using the widely tested and validated dynamic building performance software Energy Plus v8.9, to simulate the baseline summer thermal performance of the care home and identify effective mitigation scenarios, including a range of behavioural, ventilation, shading and active cooling interventions. Overheating risks were quantified under the Chartered Institution of Building Services Engineers (CIBSE) design summer year (DSY1) weather files, i.e. based on UK Climate Projections 2009 (UKCP09) and under the high emissions, 50% percentile scenario for 2020s, 2050s and 2080s.

Whilst the work undertaken for the GLA took place in the late winter of 2019 due to the timescale of the pilot study and because it was only possible to obtain heating season monitoring temperatures, the modelling output was eventually compared with the summertime data that was monitored in the pilot care home, as part of the Natural Environment Research Council (NERC) funded ‘Climate Resilience of Care Settings (ClimaCare)’ project. The heating season monitoring data is still useful for the identification of possible overheating that can occur all year round, even when external temperatures are low.

The case study's profile

Victoria Care Centre is a newly built, purpose-built setting located in west London. It accommodates 115 predominantly older residents, most whom are not independently mobile, and some residents who are under the age of 65 and living with dementia. The care home's capacity is due to increase to 153 residents because of the planned extension works. The building currently comprises of five floors, with ground floor communal spaces, offices and service rooms and four floors above that are home to the residents' ensuite rooms and lounge areas. The first floor's residents are more mobile in comparison to those on other floors and those on the second and third floors require more intense nursing care. There is currently no air conditioning present in the areas occupied by the residents but there are plans for the installation of mechanical cooling on the 6th floor, following the planned extension works to the existing five-storey building.

Findings

Victoria Care Centre was found to overheat to some extent, even during the heating season, with temperatures ranging predominantly between 26°C and 28°C in resident areas. Staff were found to be more aware than residents of the negative effects of overheating and prepared to tolerate uncomfortably hot temperatures if they felt it was the residents' best interest. The care home's most common actions for keeping the residents cool included increased fluid intake, extensive window opening, (where applicable and as far as is allowed by the restrictors), the provision of fans and moving residents to the cooler ground floor common areas. The circulation of hot water through the space heating pipework was identified as the single most intensive and unnecessary internal heat gain source in Victoria Care Centre. Other areas contributing to higher internal temperatures relate to the presence of restrictors on all windows, limiting the ventilation cooling capacity, and the lack of external solar shading systems. The dynamic thermal modelling indicated that internal temperatures will increase by 2°C in the 2050s and 4°C in the 2080s, when passive measures alone may not be sufficient for the maintenance of a comfortable and safe indoor environment. Of all passive measures tested, the combination of external window shading with the provision of an increased ventilation rate whenever external temperatures are lower than internal was the most effective, however the only way to ensure that the internal environment remains comfortable at all times, both under the current and future climate, appears to be the provision of mechanical cooling, ideally in a solar shaded and sealed environment.

The care home would significantly benefit from simple measures that could be implemented instantly, incurring minimal or no additional costs. Higher cost but often more effective measures that require more careful consideration could be implemented in the medium or longer term or as part of the building work for the addition of the 6th floor. These are summarised below:

- Minimal cost and easy to implement measures include turning off any unnecessary space heating circulation in the summer, which has been delayed due to the extensive leaks throughout the building whenever space heating is turned off and utilising curtain rules for shading.

- Measures of moderate cost and installation complexity involve planting deciduous trees for shading, applying solar control window films, (providing that their effect on winter heat load is also considered), exposing existing thermal mass and redesigning window ironmongery to allow greater window opening areas that comply with safety standards.

- Measures of higher cost and complexity could relate to passive measures, such as the application of green roofs and walls, high reflectivity paint on external surfaces, external window shading structures and water features, and/or active measures.

- Some of the low-cost measures concern behavioural changes that could be part of a wider behaviour change initiative. This can take the form of a care home management plan for the prevention of overheating, in relation to building physics and clinical issues.

To maximise the impact of reducing overheating, it is suggested that minimising internal heat gains should generally be the first course of action.

Validation of findings

Overall, the environmental monitoring, social data collection and thermal modelling results agree with the findings previously reported in literature. The findings have been further validated using the detailed environmental monitoring that was deployed as part of the NERC funded ClimaCare project. Following the 2019 summertime monitoring, the hourly modelled internal temperatures were compared with the real collected data to test confidence in the model's predictive ability.

The study's contribution

This pilot audit uses a sociotechnical approach for mitigating the risk of overheating in London's care homes that are particularly sensitive to heat-related effects. The case study provides:

(a) a methodology report, which shows the evidence-based approach taken to inform the recommendations for indoor and outdoor interventions, activities and initiatives to reduce indoor overheating in one audit pilot case study and to mitigate residents' exposure to heat;
(b) a recommendations' report detailing the factors contributing to heat exposure in the audit pilot care home, as well as the recommendation identification and prioritisation process, and;
(c) an overheating checklist (Appendix 1), produced in consultation with Public Health England (PHE) and designed to offer care homes for older residents a list of actions that can be implemented to reduce the indoor overheating exposure of vulnerable residents. It also provides a baseline for the more detailed study of overheating in care settings, that is being undertaken by the Natural Environment Research Council (NERC) funded ClimaCare project, due to be completed by the end of July 2020. A summary is also provided at Appendix 2.

Appendix 1

Best Practice Overheating Checklist

This Best Practice Overheating Checklist is a 16-point action plan that distils the most impactful and cost-effective recommendations into simple actions aimed at the care home management, using direct and simple language. It primarily focuses on interventions of the physical environment, which is only one part of the activities that should be undertaken. Care home managers will also need to ensure other adaptation activities are undertaken for individual patients, including hydration and medicine review. This checklist is designed so that all care homes can take action and, although addressed primarily to care home managers, it can also be useful to all stakeholders in the care home sector. The list comprises several recommendations from literature and the lessons learnt from the analysis of data collected as part of one audit pilot care home. Tables A, B, C and D below present the 16-point action plan grouped according to the impact areas of the adaptation measures, such as limiting sun exposure, minimising heat gains and cooling through ventilation and air movement and level of heatwave preparedness. The measures are ranked based on their all-round effectiveness, taking into consideration the GLA's cooling hierarchy [3]. Additional measures that are effective but harder to implement, for example, due to their costly and/or disruptive nature, are presented in Table E. These could be viewed as longer term solutions as part of a major refurbishment.

[3] GLA. The London Plan - The spatial development strategy or London consolidated with alterations since 2011. (2016).

Table A. Prevention measures to limit the building's sun exposure

	Adaptation strategy	Effectiveness	Affordability	Feasibility
a1	Keep curtains closed when window exposed to the sun	Medium	High	High
a2	Use heat-reflective, light coloured paint for walls and roofs	Med/High	Medium	Med/High
a3	Fit solar control films to windows	Medium	Med/High	Med/High
a4	Utilise external solar shading (e.g. in the form of shutters, louvres, side-fins and deciduous trees)	High	Medium	Medium

Table B. Overheating prevention measures to keep the heat out and limit internal heat sources

	Adaptation strategy	Effectiveness	Affordability	Feasibility
b1	Turn off any unnecessary heat sources (e.g. not-in-use lights and electrical equipment and the heating system, including both radiators and the heat circulation network)	Medium	High	High
b2	Replace any halogen or incandescent light bulbs with energy efficient light bulbs	Medium	High	High
b3	Ensure roofs and walls are well insulated	Med/High	Medium	Medium
b4	Keep windows closed when it's hotter outside than inside	Medium	High	High

Table C. Overheating prevention measures to let cool air in and increase its cooling potential

	Adaptation strategy	Effectiveness	Affordability	Feasibility
c1	Allow nighttime ventilation by letting cooler night-time air to enter the building	High	High	High
c2	Enable cross-ventilation by keeping internal doors open	Med/High	High	High
c3	Allow for increased window opening area, where there are no security concerns	Med/High	High	High
c4	Use ceiling or standing fans, without remaining directly in the draught, that can reduce perceived temperature by creating a wind chill effect	Medium	Med/High	Med/High

Table D. Overheating prevention measures in the form of an emergency response

	Adaptation strategy	Effectiveness	Affordability	Feasibility
d1	Have an overheating response plan, taking into consideration high-risk residents	High	High	High
d2	Educate staff and residents to recognise heat related stress symptoms and respond appropriately	High	High	High
d3	Identify cool rooms and ensure their temperature is lower than 26 °C at all times	High	High	High
d4	Monitor internal temperatures and move residents to cooler rooms if temperatures exceed 26 °C	High	High	High

Table E. Longer term overheating prevention solutions

	Adaptation strategy	Effectiveness	Affordability	Feasibility
e1	Enable cross-ventilation through ducts	Med/High	Medium	Med/Low
e2	Expose existing thermal mass, where possible, and/or use phase-change plasterboard	Med/High	Medium	Med/Low
e3	Provide slightly cooled air through a centralised mechanical ventilation system, either with a cooling coil or a ground-coupled heat exchanger/earth tubes	High	Low	Low
e4	Use of water features, green roofs and walls	Medium	Medium	Medium

Appendix 2

ClimaCare project overview and preliminary output

The ‘Climate Resilience of Care Settings (ClimaCare)’ is an interdisciplinary pilot project funded by the Natural Environment Research Council (NERC, NE/S016767/1) addressing the challenge of adapting UK care settings to climate change. ClimaCare work initiated in October 2019 and is due to be completed by July 2020. The project brings together research teams from University College London (UCL), Oxford Brookes University (OBU) and the London School of Hygiene and Tropical Medicine (LSHTM), who are working closely with a very active team of non-academic project partners, i.e. the MetOffice, Care Quality Commission (CQC), Public health England (PHE), Chartered Institution of Building Services Engineers (CIBSE), Greater London Authority (GLA) and PRP Architects. The project partners form the Project’s Advisory Board (PAB) that regularly review the direction of the research, advises on how the research is conducted and on how its impact can be maximised both in the UK and internationally.

Aims and objectives

The project’s aim is to undertake feasibility work by developing novel methods, knowledge and insights that will enable care provision in the UK to become resilient to rising heat stress under climate change. The specific objectives are to:

- undertake pilot work in five care homes in London to monitor their thermal environments and conduct surveys with frontline care staff and managers regarding the challenges of heat;
- test novel approaches for understanding the comfort levels of care home residents and relating this to the thermal environment;
- test novel measurement techniques for assessing the impact of heat exposure on the health of residents;
- test methods to assess future overheating risks in care settings and evaluate the effectiveness of overheating mitigation strategies on thermal comfort and health outcomes;
- bring together multidisciplinary research perspectives with those of care home practitioners and other stakeholders and use them to plan a large-scale, interdisciplinary study.

Methods

The ClimaCare project has developed a research approach to understand the summertime conditions experience by residents and staff across a range of care homes. The case study recruitment process involved approaching all London-based care homes identified either directly through Care Quality Commission's (CQC) database or indirectly through the assistance of CQC. The five care homes recruited, including Victoria Care Centre, which was recruited and utilised as a case study for the GLA's Care Home Overheating Audit Pilot Project, are in various parts of central, west and north-east London and incorporate a range of characteristics in terms of occupant capacity, building typology and age and type of construction. Their heat vulnerability is investigated through environmental monitoring and surveys, measurement of core body temperature, dynamic thermal modelling of future overheating risks and investigating the effectiveness of different strategies for reducing the risk of overheating under a range of current and future climate scenarios. Unlike the GLA's Care Home Overheating Audit Pilot Project monitoring that took place in one case study for just over three weeks (7th to 31st March 2019), the ClimaCare monitored five case studies over a period of approximately three and a half months (1st June – 19th September 2019).

Indoor and outdoor environmental monitoring

Hydrothermal loggers were utilised to record dry bulb temperature and relative humidity at repeated time points in resident rooms, communal spaces, offices, as well as outdoor temperatures in close proximity to the monitored buildings during the summer of 2019.

Social surveying

The environmental monitoring was accompanied by occupant surveys to relate the residents' thermal sensation with the indoor environment, activity and clothing levels. Semi-structured interviews were also conducted with frontline staff carers, managers and building professionals to enhance end-to-end understanding of how overheating is currently managed in practice and assess existing environmental, behavioural and organisational barriers to the implementation of heat risk mitigation strategies in such settings.

Core temperature and heart rate monitoring

The psychological responses to high ambient temperatures are assessed in a subset of 20 randomly-chosen care home residents. On selected hot weather days, participants are asked to (a) provide information on their activities and thermal comfort sensation at regular intervals, (b) ingest a telemetric temperature monitor to measure their core body temperature and (c) wear a heart rate monitor that measures changes in resting heart rate. This aspect of the ClimaCare study was not an element of GLA's Care Home Overheating Audit Pilot Project. ClimaCare aims for it to be deployed in all five case studies.

Dynamic thermal modelling

The physical, technical and user characteristics of each building to be used as input in the EnergyPlus V8.9 dynamic thermal simulations were established via physical surveys. The performance of the thermal models was compared against the monitored temperatures. Following the testing and calibration, current and future overheating risks were quantified using the CIBSE weather files for the 2020s high emissions (50th percentile) and 2080s low- and high- emissions scenarios (50th percentile). The 2020s weather file represents current climate and the 2080s low- and high- emissions scenarios are representative of the projected 2°C and 4°C Global Mean Surface Temperature (GMST) increase above pre-industrial levels [4]. The effectiveness of a wide range of climate change adaptation and overheating mitigation strategies were tested, such as behaviour change, management practices, building design, retrofit and operation.

Community building

The multidisciplinary research perspectives in the areas of climate science, building thermal simulation, building monitoring and health are drawn together through the ongoing engagement with non-academic stakeholders and focus-group based workshops to explore (a) ways of working and developing plans of interventions that could be tested in subsequent larger-scale work, and (b) explore implications for guidelines and regulations relating to the design and operation of care settings from the perspective of thermal comfort.

Emerging findings

The preliminary project findings show that the care home age may play a critical role in overheating. Staff and residents in older, heavyweight buildings were less likely to feel hot in the summer. Monitored summertime temperatures were generally higher in bedrooms than lounges and average daily temperatures were between 23 ºC and 29 ºC, with the exception of heatwave periods, when they soar well above 29 ºC. The daily maximum temperatures recorded ranged between 31.2 ºC and 34.3 ºC. Residents appeared to be content with their conditions, even at temperatures in excess of 30 ºC while members of staff consistently described their conditions as warmer than reported by the residents. However, staff members were willing to tolerate uncomfortably hot temperatures if they felt it was in the residents' best interest.

Initial analysis from the dynamic thermal modelling of the five case study care homes during a five-day heatwave period (22nd – 26th July 2019) indicated that the average internal temperatures experienced by active and bedbound occupants are expected to increase by approximately the same degree as average external temperatures, i.e. 1.5 ºC and 3.9 ºC under the 2080s low- and high- emissions scenarios, respectively. The modelled 2020s average internal temperatures remained predominantly above 26 ºC in all case study care homes and were projected to remain at significantly higher levels under the future climate

[4] DEFRA. The National Adaptation Programme and the Third Strategy for Climate Adaptation Reporting: Making the country resilient to a changing climate (2018)

scenarios. A combination of selected soft- and hard- engineered passive strategies reduced temperatures between approximately 1.3 ºC and 4.4 ºC, depending on the building type. However, they were not able to reduce average temperatures below the 26 ºC threshold, under any of the climate scenarios tested. The findings indicated that older buildings with higher heat loss and thermal mass capacities are likely to benefit more from the application of high albedo materials rather than external shading methods, whereas newer and highly insulated buildings seem to benefit more from higher ventilation rates and appropriate external shading systems. Overall, modern buildings were found to benefit more from passive interventions rather than older buildings, with the latter maintaining slightly lower temperatures at all times. Night ventilation emerged as the single most impactful passive technique for all building types.

A national scale follow-up project

Building on the foundations of the ClimaCare pilot project and taking into account the findings from the GLA's audited care home, Victoria Care Centre, the follow-up 'Governing the Climate Adaptation of Care Settings' project proposed by the ClimaCare team has been funded by the UK Research and Innovation (UKRI). This is a 28 month larger-scale interdisciplinary study, with a start date from 1st May 2020. This novel interdisciplinary project aims to quantify climate related heat risks in care provision at a national level, and enhance our understanding of individual behaviours, organisational capacity and governance to enable the UK's care provision to develop equitable adaptation pathways to rising heat stress under climate change. It will collect, for the first time in the UK, longitudinal temperature and humidity data in a panel of 50 care settings in order to quantify the recurring risk of summertime overheating. The project will also identify and assess social, institutional and cultural barriers and opportunities underpinning the governance of adaptation to a warmer climate in care and extra-care homes. The team will work closely with stakeholders from a range of disciplines to participate in the development of health and climate resilient care setting case examples. The project aims to generate impact scenarios along three main pathways:

Pathway 1

By providing building construction practitioners responsible for the design and delivery of healthy care homes with improved climate change adaptation design and decision making tools. This will facilitate the development of best practice guidance provided by professional organisations and associations.

Pathway 2

By providing policymakers and regulators, such as the CQC, with evidence-based recommendations to help revise regulation and policies pertaining to thermal comfort and energy efficiency in care settings.

Pathway 3

By providing care home managers, frontline staff and residents with best practice guidelines for the optimum operation of care environments in a warming climate.

Quality control process

The project methods, findings to date and future work proposal presented here have been discussed in detail by all project partners during the regular PAB meetings. They have also been reported extensively in project workshops and presented to the CQC, as part of the Adult Social Care (ASC) Extended Leadership Team meeting.

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