

## WellHome: A Community-Based Study for Investigating Indoor Air Pollution in an Urban Community in London.

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## Air pollution - the facts

**9 in 10**

people breathe polluted air worldwide



**1 in 9**

deaths caused by air pollution - killing **7 million** people every year



**3.8m**

deaths caused by household air pollution in 2016

**98%**

of cities with more than 100,000 inhabitants fail to meet air quality guidelines



**4.2m**

deaths caused by ambient air pollution in 2016



SOURCE: UN/WHO

Low birth weight

Smaller lungs  
Cognitive ability?

Increased risk of chronic disease  
Acute respiratory exacerbations

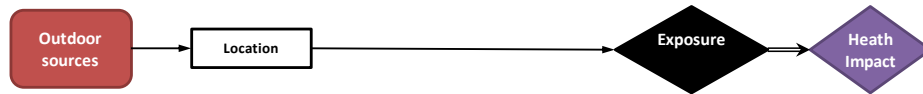
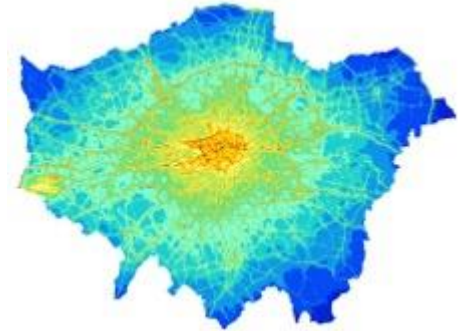
**Increased vulnerability**

**Quality of life**

Acute and chronic  
Premature death

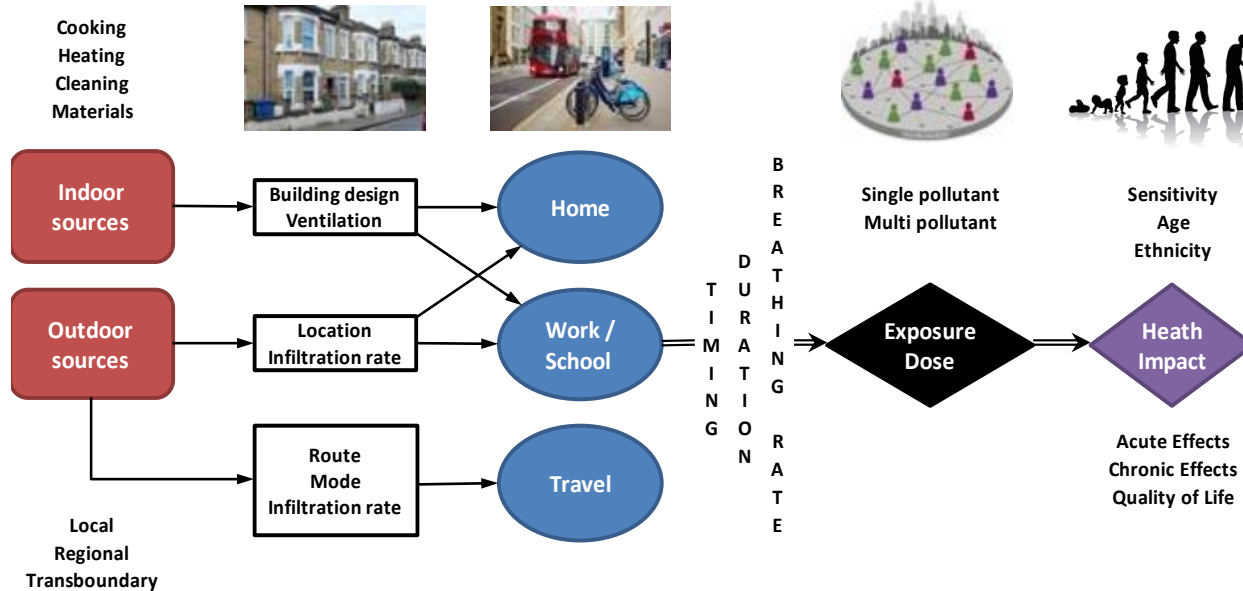


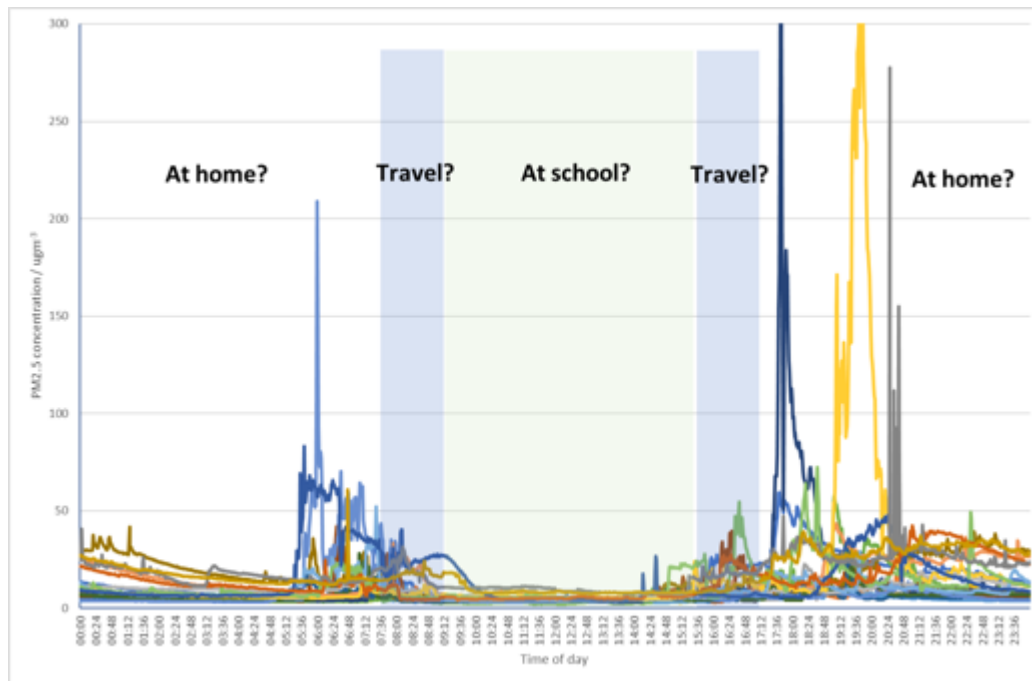
- The 'traditional' view of exposure assessment is impersonal, based on city or neighbourhood.
- Important for historical health associations and air quality management (legislation).



But its far more complex than that...

## Exposure is complex and personal





**We spend about  
90% of our time  
indoors**

It is important that we improve our understanding of air pollution in our homes - where it comes from, how it behaves and how harmful it is.

There are sources indoors too . . .



Despite its importance in human exposure terms, links between indoor air quality in its widest sense and public health is an under-researched area, particularly in the UK.

.... Measuring indoor air pollution can be challenging!

The **WellHome** study has been co-designed with the local community from the outset.



## The Pilot



**Research Question:** “Should people let the pollution in or let the pollution out?”

- ✓ Research studies in the area should prioritise families with young children and marginalised communities
- ✓ Use of local ‘ambassadors’ and local partners as a trusted face for the study
- ✓ Methodology should incorporate a “feedback results stage
- ✓ Research study should bring positive changes for the area and its residents

**Co-designing residential air pollution research  
(2019-2020)**

UKRI Public Engagement - Citizen Science Exploration Grant

# A community-based research project in west London focusing on the indoor/outdoor air pollution continuum and its impact on asthma



The WellHome study aims to identify predominant indoor air pollution exposures to children and adults in vulnerable urban communities, emphasising community involvement in co-designing feasible and acceptable research methodologies.



# A strategic and inclusive approach to I/O air quality and its health effects



**WellHome**  
Healthy home environment study



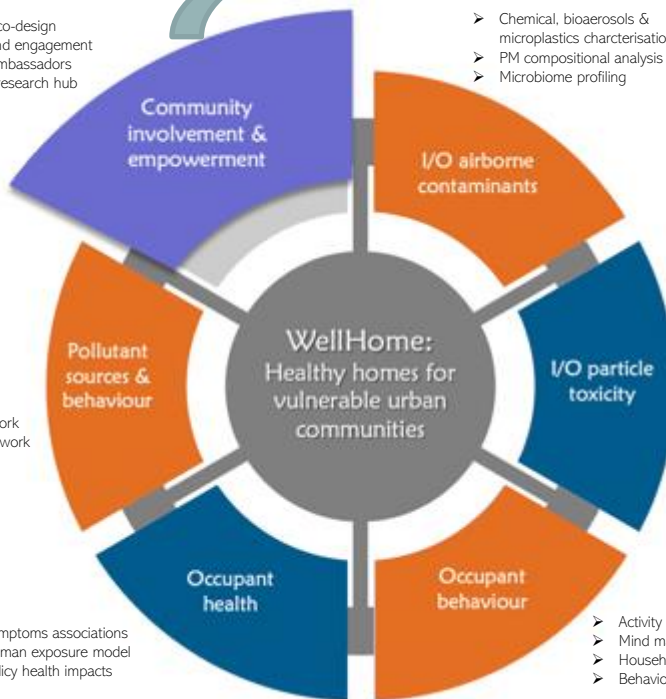
- Community co-design
- Education and engagement
- WellHome ambassadors
- Community research hub

- Chemical, bioaerosols & microplastics characterisation
- PM compositional analysis
- Microbiome profiling



- Indoor sensor network
- Ambient sensor network
- PM characterisation
- Exposure modelling

- Symptoms associations
- Human exposure model
- Policy health impacts



- In vitro toxicological hazard model
- Oxidative potential determination
- Upper airway responses to I/O PM
- Predictive personal toxicology

- Activity Diary
- Mind mapping interviews
- Household behaviour survey
- Behavioral policy impacts



Engagement  
Involvement  
Participation



Engagement and Involvement Activities



West London Community

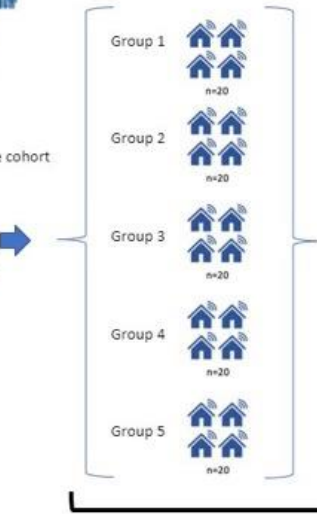


Participation

Recruitment of WellHome cohort



WellHome Network (n=100)



Campaign 1

Home visit 1 - Installation Day

- Questionnaire 1
- Air pollution sensors & samplers installation

Daily activity symptom questionnaire  
4 weeks

Home visit 2 - Retrieve day

- Questionnaire 2
- Air pollution sensors & samplers collection

Feedback Report

Campaign 2

Home visit 3 - Installation Day

- Questionnaire 3
- Air pollution sensors & samplers installation

Daily activity symptom questionnaire  
4 weeks

Home visit 4 - Retrieve day

- Questionnaire 4
- Air pollution sensors & samplers collection

Feedback Report

3 - 6 months

Engagement Activities

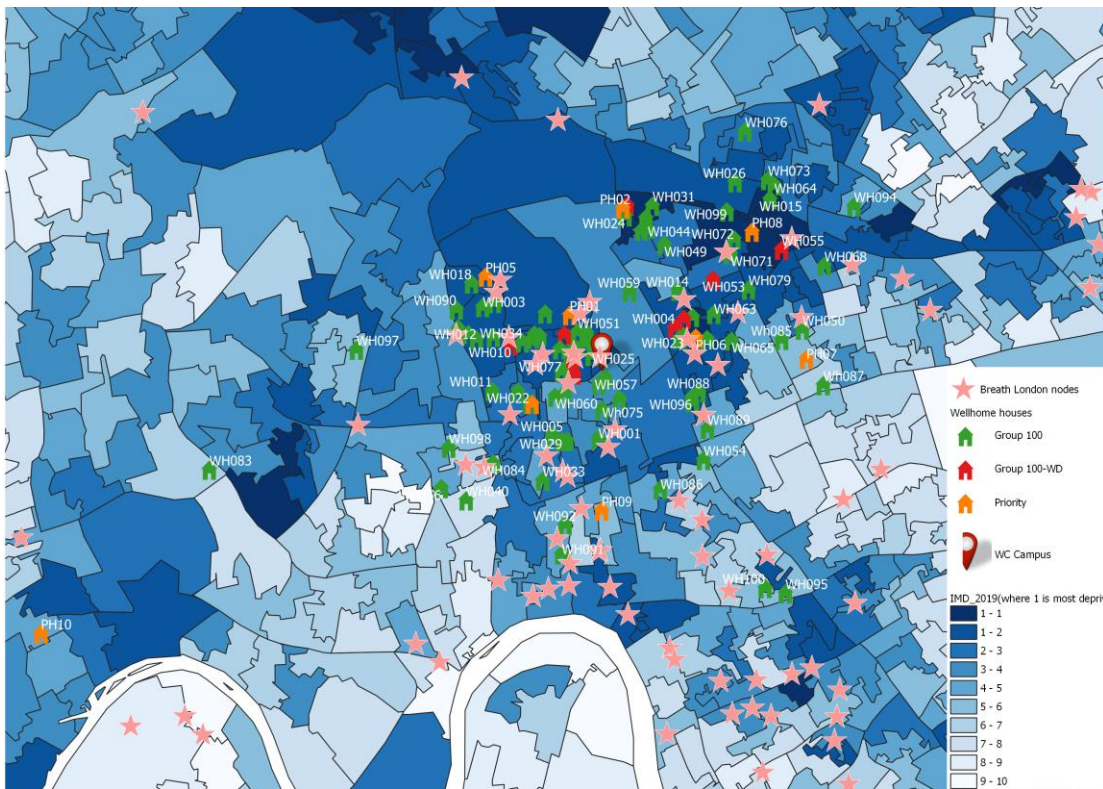
Involvement Opportunities

Community Air Quality Research Hub



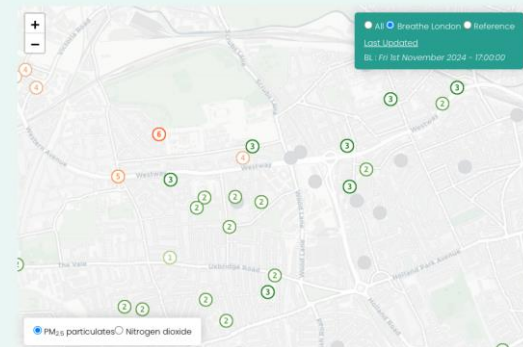


**WellHome**  
West London Healthy Home and Environment Study



**Breathe London**  
the community sensing network  
part of the Environmental Research Group at Imperial College London

### Current air quality



**Breathe London**  
the community sensing network  
part of the Environmental Research Group at Imperial College London

**MRC**  
Centre for Environment & Health



Medical Research Council

Imperial College London



Centre for Climate Change and Social Transformations



Asthma UK Centre for Applied Research



## Engagement

Where information and knowledge about our research is provided and disseminated. Examples of our engagement activities are:

- Participation in local **festivals and community events**
- **Educational sessions** with local community partners
- Distribution of science **activity packs**

*These activities were designed to ensure that the entire community has opportunities to learn about the causes and effects of air pollution, as well as strategies for reducing their exposure to harmful pollutants.*

### ENGAGEMENT



'Air Quality Investigation Lab'

WH

We aim to ensure that our air quality research is conducted collaboratively with and by the community, rather than being done to, about, or for them!

## Participation

Where members of the community have engaged in our research study through the following activities:

- Gathering their own indoor air pollution data
- Completing surveys and participating in interviews

Moving forward, we aim to continue collaborating with WellHome families to establish a **community air quality research hub**. This hub will integrate a network for monitoring residential indoor and outdoor air quality, facilitate information exchange, and offer educational programs.

## Involvement

Where members of the public are actively involved in our research through various avenues, for example:

- **Focus Groups:** Contributing to the development of our engagement strategy and methodological approach and co-designing the findings reports.
- **Steering Group Membership:** Participating as members of our steering group to guide research direction.
- **WellHome Community Ambassadors Model:** Serving as key bridges between the research and the community, facilitating communication and understanding.

### INVOLVEMENT



Co-design focus groups

### PARTICIPATION



Measuring air quality indoors



WellHome  
West London Healthy Home and Environment Study



West London  
Community



WellHome Network  
(n=100)



UK Urban Communities

# Participating homes

Our 100+ homes are located mainly in W10, W11, W12 postcodes or the surrounding area. They come from wide-ranging backgrounds and represent the rich cultural, ethnic and religious diversity of West London.

480



total participants in the WellHome study

257



children in the WellHome study

51%



of families have children with asthma

42%



of families have children with allergies

61%

of families live in purpose-built flats or tenements



71.8%

of families live in the top most deprived\* areas of the UK

\*IMD (Index of Multiple Deprivation) measure used in the UK to assess level of deprivation in different geographic areas.

39%



of families speak additional languages

74%

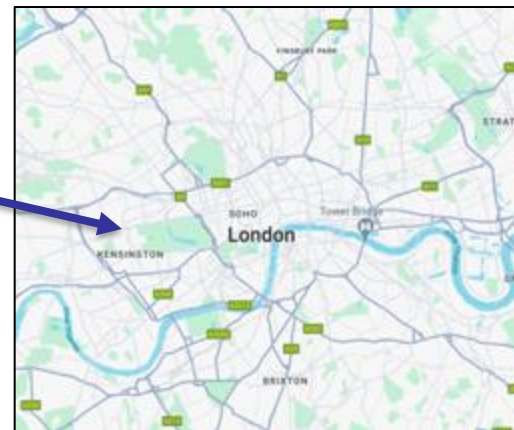


of families are from minority ethnic backgrounds



## WellHome

West London Healthy Home and Environment Study



MRC  
Centre for Environment & Health



Imperial College  
London



Centre for Climate Change  
and Social Transformations



Asthma UK Centre  
for Applied Research



# 01. Listening, Learning and Understanding.

Early 2022

## Growing awareness and understanding

Valuable conversations with key gatekeepers and organisations reveal that **respiratory conditions, allergies and housing problems are rife in the local community.**

Spring 2022

## Community Ambassadors joined WellHome!

Since joining our team, the Community Ambassadors have been our main advisory group, acting as **key bridges between local families and our research.** Their knowledge and experience have greatly contributed to informing our methodological approach and enhanced our outreach to diverse community networks.

Summer 2022

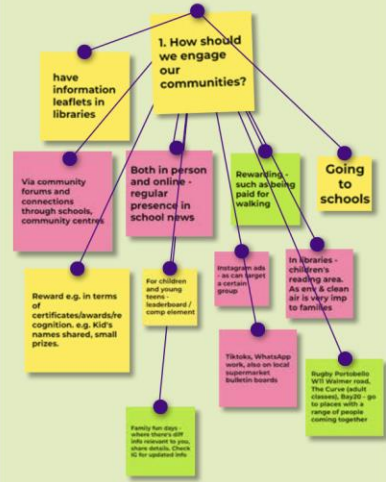
## Shaped by local needs and concerns

We engaged in two-way dialogue with local groups and stakeholders in various community settings. They recommend that our study emphasise the **health impacts** of air pollution and identifying key vulnerable groups to engage with. Their insights shape our approaches and protocols.



Family fun days and community festivals

## Brainstorming Engagement Approaches



# 02. Relationship Building and Connecting the Dots

Spring  
2022

Summer  
2022

## WellHome First Big Engagement Event in the Community

'Discovery Day' was a science-packed festival where participants learned about WellHome via engaging science activities, including arts & crafts, talks and experiments. [Click to watch the highlights video!](#)

## Engaging with Local Families and Groups

Local post-pandemic events, such as the Queen's Jubilee Street Parties in Old Oak and White City, enabled us to connect with key audiences such as families with children with asthma, Resident Associations, health & environmental groups, and local charities. These opportunities allowed us to **establish relationships in the community to further listen, share and learn.** To celebrate Clean Air Day 2022 and strengthen our connections with the local community, we hosted a panel discussion titled "Our Neighbourhood, Our Air" at Edward Wood's Estate, in West London.

**165+**  
organisations &  
groups engaged  
from 2021-24



# 03. Making Science Accessible

Summer 2022

## A Day in the Life of a Scientist for Clean Air Day

For the very first time, the Environmental Research Group opened their laboratories and offices to the public. The event was a resounding success, with all participants expressing a newfound desire to learn more about how air pollution impacts our health.

Large-scale summer events & festivals allowed us to connect widely, identifying local families with children who have asthma or allergies.

We also created a video for our families, featuring our experts and revealing the science of WellHome. In the video, we aimed to offer an insider's view of our work and the scientific processes involved.



300+

We delivered over 300 engagement activities

144

professionals involved in WellHome Engagement. Including 79 researchers, 35 professional staff, and 30+ external collaborators



"We most enjoyed seeing a **real lab!**"

Child  
Participating family

"The (day in the life of a scientist) was absolutely beneficial for the parents and the children - **this will make the children interested in becoming scientists.** Because of today I know what to expect of the WellHome study and will be more familiar with the equipment in our home. This will help me to be more involved in what's happening in the home - so I can understand the importance of pollution and how it affects our home."

Mustaphe O Muse  
Father in a participating family





# 04. Broadening Awareness with Engaging, Accessible Communications



Face to face meetings proved highly effective for recruitment. We primarily recruited from community events (28%), which facilitated trust and relationship-building. Our recruitment strategy also involved our 10 Community Ambassadors and their own local networks (22%), and a mass leaflet and posting campaign (6%), leveraging community partners' networks and local schools.

We translated our leaflets into Somali, Amharic and Arabic.

We featured in local newspapers and bulletins, including White City's The Local, East Acton Times and Queen's Park Council's.



**118+**

Venues sharing promotional materials



**10k**

Leaflets distributed



**250**

Recycled WellHome tote bags given



**452**

Expressions of Interest to participate in the study



**213**

Sign ups to the general WellHome mailing list



Can you identify different things in the house that may affect our health?

# 05. An Organic, Adaptable, and Responsive Engagement

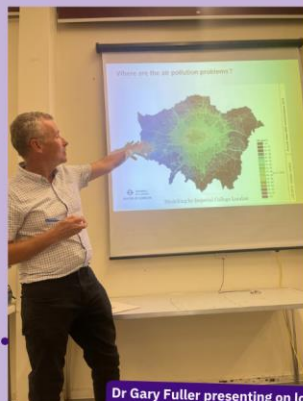


**WellHome**  
West London Healthy Home and Environment Study

Responding to the needs of our community partners Bubble & Squeak and NOVA, we ran air quality activities during holiday clubs and after-school sessions, strengthening our relationships with local families.



Dr Will Hicks at an Air Quality action event in North Kensington, with the charity *Hope for the Future*



Dr Gary Fuller presenting on local air quality levels at the White City Community Centre



Summer  
2022

Sep  
2022

## Making science fun!

Imperial's Sustainability Working Group run pollution scavenger hunts for kids in Wormwood Scrubs!

In response to community feedback, we also organise asthma workshops at The Dalgarno Trust, and environmental community film screenings for all ages.

## Working with local organisations

Reflecting on what works, we took a more adaptable approach to events, avoiding duplication of effort and resources. We provided high-quality activities to strengthen local causes and campaigns, coming together with local organisations as a joint effort. One example is connecting the Cost of Living Crisis with Air Quality.

Involving Somali women was integral to the campaign as they are powerful linchpins of families and communities, and thus healthy homes.

More in-depth projects and a consistent presence allowed us to develop greater acceptance, trust and understanding in the local community.

MRC  
Centre for Environment & Health



Asthma UK Centre  
for Applied Research



# 06. Connecting Art, Air Pollution, and the Community

Creativity is key for exploring the unknown. Over a series of hands-on workshops, artist Mo Langmuir, originally from West London, and community champion Janis Walton worked with families from the Girls Create a Vibe (White City) and Old Oak kids clubs to explore views of local air pollution. This resulted in not your typical map! The artwork reveals Nitrogen Dioxide levels in W10, W11 and W12 postcodes, combined with feelings and movements of participants over a 24 hour day, through prints, drawing and stitchings.

Exploring the idea of the indoor-outdoor air pollution continuum with 100 people



The collaboration resulted in a transportable, educational resource used at over 25 engagement events to encourage dialogue about local air quality and environmental research, with people from all ages and backgrounds.



Credit: Mo Langmuir, 2022



# 07. Opportunities for Honest and Meaningful Dialogue

Local residents also emphasised the importance of conversation and discussions with experts, encouraging more diverse ways to listen, learn and express, connecting the community's concerns with scientific research. With LBHF Council (LiveWell Festivals), we hosted free and open discussions in public parks to widen the conversation around air pollution, our lived environments and health.

Talkaoke sessions broke down barriers between researchers and local residents, bringing a human face to science diverse opinions and tensions, such as mistrust of universities and research agendas, were able to surface and be exchanged air pollution issues and debates were broadened and deepened.

**“Why are you talking about air pollution? I want to know why everyone around me is dying from stroke.”**

**Local resident**

**“Air pollution also contributes to stroke...”**

**WellHome Scientist**



‘Talkaoke’ is run by the The People Speak - an artist collective designing tools for collective imagination

# 08. Equipping and Empowering Community Ambassadors as Key Community Bridges

**Awareness of WellHome was now growing strong in the community. We focused our efforts on empowering our Community Ambassadors by enhancing their strategic skills and involving them more deeply in the study.**

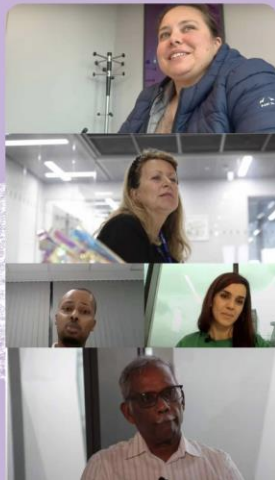
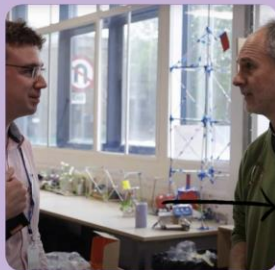
We welcome new and talented Ambassadors throughout our journey. Over delicious lunches, we decided engagement priorities for the year ahead, and reflect on challenges and opportunities.

We delivered **tailored training sessions** for Ambassadors including:

- Imperial's Introduction to Air Quality Certified Course
- Storytelling & Public Engagement
- Making Networking Work
- Schools Outreach

Our WellHome ambassadors created a participatory video showcasing insights from researchers, participants, community organisations, and local groups about the impact and challenges of our engagement approach. Watch the fantastic video [HERE](#).

Ambassadors supported **29** WellHome fieldwork visits



WellHome Engagement Journey Page 29



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West London Healthy Home and Environment Study



Community Ambassadors visit the Wellcome Collection

# 09. Sustaining Relationships and Growing New Ones

WH



Early 2023



## Engaging with Schools

Utilising vital connections from the Ambassadors, we adapted our approach to work with schools in flexible and spontaneous ways. These included **pop-up stalls**, **conversations at school gates**, and **parents' evening talks**. This allowed us to engage with often-overlooked communities and groups.

We developed exciting WellHome and Breathe London assemblies, which explored indoor and outdoor air pollution, connecting researchers with school pupils.

The session had a profound impact on the participating teachers, with 100% of them expressing an increased motivation to learn more about the environment, health, and air pollution. Additionally, **every teacher reported that their session significantly enhanced their knowledge of environmental challenges.**

Pupils described our Air Quality workshops as: **'Really fun!'**

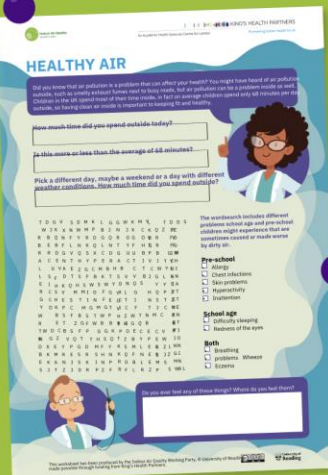
**'I enjoyed the quiz with the bubble suits'**

**'I only want to say it was really good and I love it'**

30 schools engaged

19 in-person sessions

481 total pupils reached



WellHome Engagement Journey Figure 22

We also returned back to schools in Spring 2024 with various fun-filled assemblies and workshops!

We distributed 200 educational packs. These materials, produced by WellHome in partnership with the Indoor Air Quality Working Party and The Invention Rooms at Imperial College London, included fun activities about air pollution for children to learn about it.

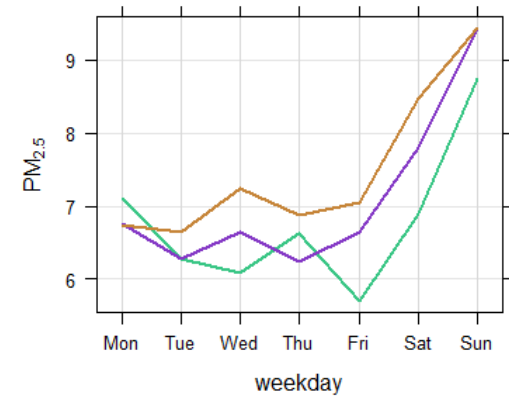
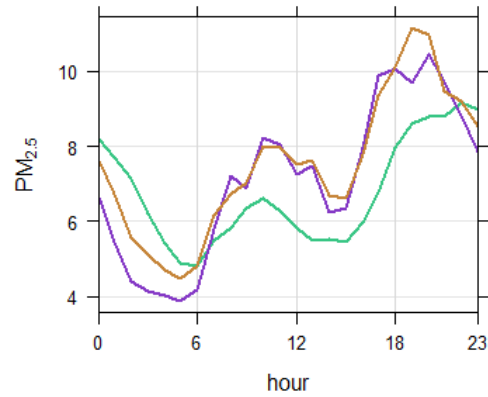
## Gathering with Families: Sharing Meals and Insights

We had enrolled 56 families and marked the milestone by hosting our first Family Dinner – a warm and welcoming space for families to engage with experts, enjoy interactive activities, and connect with others, while savoring delicious local food! These dinners have been essential for acknowledging the contribution of our local families and partnership with scientists.

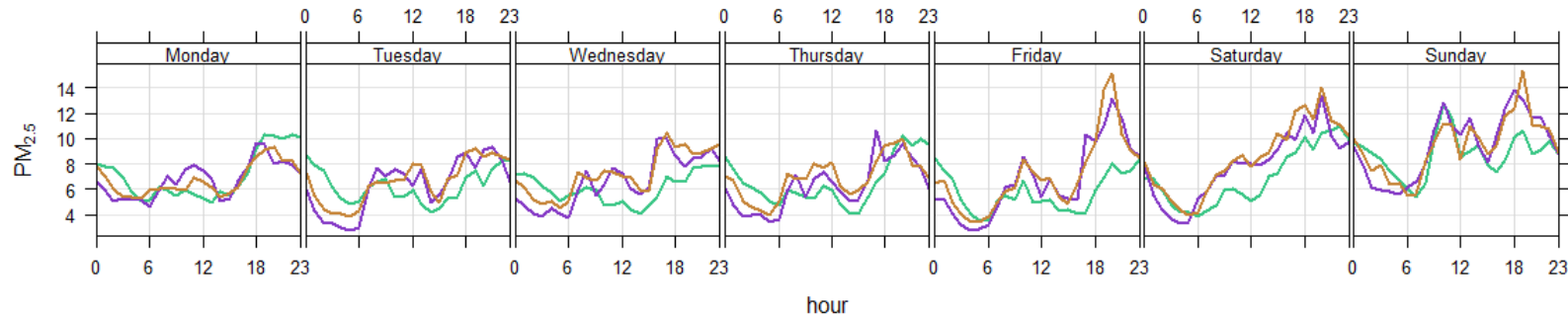


# 10. Connecting with the science: Co-Designing Reports with Families

Preliminary Results (Campaign1)



Bedroom Kitchen Lounge



# 10. Connecting with the science: Co-Designing Reports with Families



Spring  
2023

## Co-designing reports

We held several focus groups with participating families to collaborate on the content and presentation of our reports. Their ongoing feedback continues to shape our understanding and interpretation of the results.

“You can feel people are really listening to us. All the team members are so kind. It was so great to be with people who are also going through the same breathing issues. I don’t know how they gathered a whole team of people who are so nice – I always feel so connected.”

WellHome Participant



WellHome families contributing their thoughts towards putting together the first WellHome report

I don't not like it  
It is hard to understand  
But it looks nice!

## Participants Feedback

Some kind of guideline or comparison reference of PM<sub>2.5</sub> safety levels

Show us the PM<sub>2.5</sub> values

Compare the rooms in their home

Compare our own home to the average

How does the time of day affect PM<sub>2.5</sub> levels in my home?



# 21

families have participated in the co-creation of the WellHome reports.



# Conclusions and next steps



- Preliminary findings highlight locations and times within participating households where air pollution peaks are most prevalent. Ongoing analysis will explore connections between these findings and participant behaviours and health.
- PM<sub>2.5</sub> results will be combined with a suite of additional metrics simultaneously gathered in each home, including bioaerosols, chemical contaminants, microplastics, temperature and humidity.
- Involving people in the research process, while time- and resource-intensive, offers significant benefits that can greatly enhance the quality and impact of the research.
- We will continue to communicate results to participants through co-designed reports, providing advice and information on actionable ways in which they could improve the air quality in their homes.
- Anticipated outcomes include offering clear information to shape effective recommendations for householders, authorities, and policymakers, thus fostering healthier home environments.

# The WellHome team



**Principal Investigator:** Professor Frank Kelly - Imperial College London (ICL)  
**Co-investigators:** Dr Benjamin Barratt (ICL), Dr David Green Imperial (ICL), Professor Klea Katsouyanni (ICL), Professor Margaret Dallman (ICL), Professor Wouter Poortinga (Cardiff University), Dr Leon Barron (ICL), Dr Ian Mudway (ICL), Professor Matthew Fisher (ICL), Dr Stephanie Wright (ICL), Professor Chris Griffiths (Queen Mary University of London), Dr Sean Beevers (ICL), Dr Heather Walton (ICL), Dr Diana Varaden (ICL), Dr Anja Tremper (ICL), Dr Tuan Vu (ICL), Dr Dimitris Evangelopoulos (ICL).  
**Community Engagement Officer:** Esther Lie

**And our WellHome Ambassadors and communities in W10, W11 & W12**



## Our Partners:



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 @StudyWellHome

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