

## EPSRC Engineering Healthier Environments Workshop: summary note

### Background

Engineering Healthier Environments is a priority area identified in our [Health Technologies strategy](#) under the Improving Population Health and Prevention Challenge.

In May 2023, EPSRC carried out an initial survey of the community to understand some of the challenges and opportunities in this space.

On 19<sup>th</sup> October 2023, we held a virtual workshop on the topic. The workshop brought together researchers and interested stakeholders, with 47 participants attending from across academia, industry, policy, and other funding agencies.

The workshop included stakeholder perspectives on how we can engineer healthier environments to help prevent ill health and promote increased wellbeing as well as breakout sessions to discuss priority research challenges and the support needed by the community from EPSRC to effectively engage in this space.

### Objectives

The objectives of the workshop were to:

- To initiate a dialogue in the context of our new Health Technologies Strategy to help inform future EPSRC activities in the area of engineering healthier environments to help prevent ill health.
- To identify priority research challenges/opportunities in this space and the role engineering and physical sciences research can play.
- To understand what support the community need from EPSRC to effectively engage in this topic.

### Agenda

Overview of the workshop agenda:

10:00	<p><b>Welcome and introduction</b> Chair: <b>Prof. Tim Sharpe</b>, Head of Architecture, University of Strathclyde</p>
10:20	<p><b>Scene setting session</b> Speaker perspectives on how we can engineer healthier environments to help prevent ill health and promote increased wellbeing using physical sciences and engineering research.</p> <p><b>Prof. John Bridgeman</b>, JW Hughes Chair of Engineering and Head of Department of Civil Engineering and Industrial Design</p> <p><b>Dr Andrew Fraser</b>, Former Director of Public Health Science, NHS Health Scotland</p> <p><b>Monique Staff</b>, PPIE representative through Asthma and Lung UK</p> <p><b>Prof. m.c. Schraefel</b>, Professor of Computer Science and Human Performance, University of Southampton</p>
11:20	<p><b>Break</b></p>
11:35	<p><b>Breakout session: Challenges and Opportunities</b></p> <ul style="list-style-type: none"> <li>• What are the most pressing challenges and opportunities around engineering healthier environments to help prevent ill health?</li> <li>• What role can engineering and physical sciences research play in addressing these challenges?</li> <li>• Where can the engineering and physical sciences community have the biggest impact on this topic?</li> </ul>
12:20	<p><b>Feedback and discussion following breakout session</b></p>
12:40	<p><b>Lunch</b></p>
13:35	<p><b>Breakout session: What support does the community need from EPSRC to enable impactful research in this area?</b></p> <ul style="list-style-type: none"> <li>• How connected are the Engineering and Physical Sciences research community on this topic?</li> <li>• What stakeholders should the Engineering and Physical Sciences community be engaging with on this topic?</li> <li>• What type of activities and support would you like to see EPSRC deliver and be involved in to enable impactful research in this space?</li> </ul>
14:20	<p><b>Feedback and discussion following breakout session</b></p>
16:00	<p><b>Closing remarks and meeting close</b></p>

## Summary of discussions

During the two breakout sessions participants discussed the following sets of questions:

### Challenges and opportunities:

- What are the most pressing challenges and opportunities around engineering healthier environments to help prevent ill health?
- What role can engineering and physical sciences research play in addressing these challenges?
- Where can the engineering and physical sciences community have the biggest impact on this topic?

### Support needed:

- How connected are the Engineering and Physical Sciences research community on this topic?
- What stakeholders should the Engineering and Physical Sciences community be engaging with on this topic?
- What type of activities and support would you like to see EPSRC deliver and be involved in to enable impactful research in this space?

Overall, some of the common themes highlighted were:

- Engineering healthier environments is a broad topic with many complex challenges. Some broad areas where engineering and physical sciences could have a positive impact include:
  - healthier indoor environments,
  - healthier outdoor environments,
  - technologies to support primary prevention,
  - designing for an ageing society,
  - healthier environments to support mental health and wellbeing.
- While there are good connections/networks within disciplines, support is needed to build networks and facilitate more cross-disciplinary and cross-sector collaboration and engagement e.g., with social scientists, local authorities, charities, NHS and health professionals, the public, and end users.

- To promote and create healthier environments for the whole of society we need to consider and address health inequalities and promote health equity at all stages of research and innovation.
- Co-creation and patient and public involvement and engagement (PPIE) are important to embed in research from outset to ensure we are addressing real world issues and challenges.

The outputs of the workshop will inform future EPSRC activities on the topic of engineering healthier environments.

A complete summary of the discussions among workshop participants can be found in **Annex 1**.

## Annex 1: Complete Summary

A summary of the key discussions among workshop participants is below:

### **What are the most pressing challenges and opportunities around Engineering Healthier Environments (EHE) to help prevent ill health?**

#### **Indoor environment:**

- Improving air quality in homes (affordable, simple evidence-based solutions)
- Mould free homes
- Heating
- Poor insulation
- Ventilation
- Air Conditioning
- Cost of living
- Retrofit and improvements to rental and social housing
- Smart infrastructure to address social care crisis (unobtrusive sensors integrated into buildings)
- What do smart homes look like in social housing

#### **Outdoor environment:**

- Holistically redesigning the city to enable and help people to achieve better health
- Strategies to improve urban air quality
- Autonomous pollution control
- Smart infrastructure and smart sensors
- Sustainable transport/infrastructure
- Accessibility and engagement for all - making the built environment meet the needs of the young, the old, people living with disability, etc.

#### **Primary prevention**

- Engineering and Physical Sciences methods and technologies to increase level of activity and exercise amongst population, including strength training
- Digital technologies with a focus on prevention rather than treatment
- Availability of healthy food
- Reduce the burden on the NHS
- Empower people to self-manage their health
- Promote independent lives

#### **Designing for an ageing society**

- Ageing infrastructure
- Improving healthy ageing to reduce years lived with disability

- Ageing societal demographics
- Increasing activity to reduce the risk of falls
- Inclusive environment and design that allows healthy ageing – managing chronic disease

### **Mental health and wellbeing**

- The built environment has profound effects on both physical and mental health. It would be good to see more done to address the impact on mental health.
- Digital technologies for self-monitoring and self-care

### **Addressing health inequalities**

- Focusing on ill health equitably
- Finding solutions which target and don't disadvantage marginalised groups
- Ensuring public involvement groups are diverse, representative of the whole population and target underrepresented groups
- Place based approaches to reducing health inequalities. Targeting where inequalities are greatest e.g., inner cities, north/south divide

### **Codesign and end user engagement**

- User-centered design - design solutions around the needs of users/patients
- Holistic buy in – the approaches need to be adaptable to a wide range of stakeholders but need to come from a 'people first' approach e.g., if we want clean air, the approach needs to be usable in schools, homes, councils, government etc.
- End user buy in – trust and overcoming ethical issues e.g., monitoring, AI, data, automation
- Co-design across disciplines and sectors
- PPIE groups should be engaged from early stages of research

### **Data**

- Comprehensive tools for aiding individuals and policy makers to evaluate what actions are most appropriate to a given situation. Based on engineering and physical sciences expertise in data analysis and modelling.
- Producing good enough quality data that can lead to effective interventions
- Bridging the gap between detailed datasets/models and practice and implementation

### **Technologies**

- Sensors - ambient sensing to create more effective/accurate digital twins. Less intrusive sensors have the potential to lead to better uptake/acceptability e.g.,

sensing health through chair pressure sensors or radar technologies could lead to better uptake than if someone is required to wear a pendant/smartwatch

- Sustainable technology solutions
- AI and robotics
- Socially assistive robotics to enable people to live and work with a level of independence

### **Where can the engineering and physical community have the biggest impact?**

- Identify and address real world issues and problems from beyond an individual's core community. Public, patient and end user engagement is key.
- Focus should be on implementation. For example, the need for open space, clean air, clean buildings are well established and there are some theoretical solutions but the practical implementation still requires EPS input
- Demonstrating how improvements are made on real, full-scale problems in a holistic way with collaborators from other disciplines.
- Developing innovative technologies e.g. sensing technologies

### **How connected are the engineering and physical sciences research community on this topic?**

Very broad topic. There are good connections within specific fields/disciplines but not in between the fields/disciplines (e.g., civil engineering not well connected to health technologies). The competitive nature of research funding can prevent connectivity, creating siloed pockets of funding.

### **Existing connections to build upon:**

- EPSRC & NIHR independent living funding programme.
- Air quality communities have become well connected in the past few years following NERC SPF initiatives. These communities are mostly environmentally focused rather than health focused. EPSRC could do more to connect people around air quality with a specific health focus.

### **Needs:**

- Link groups within the EHE space and create a community. Connect engineering and physical science researchers with organisations outside of this space might be more important than connections with other engineering and physical science researchers. (Landscape mapping?)
- Create connections between typical engineering and physical science areas and public health areas (currently difficult for researchers to apply for complex prevention and population health projects)
- Multidisciplinary co-creation/co-design
- Create common language among the disciplines - technical details vs big picture view; include social sciences and health economists

- Improve awareness of what infrastructure research facilities are available that can be used to advance health technology.
- More connections with third/public sector
- Integration across UKRI
- Connections/networking need facilitation and long-term collaborative bid-building plan to maintain the research (e.g., UKPRP model but longer timescale)
  - o Connections facilitated by consensus building and research priority setting and identifying the gaps in knowledge (e.g., embedding health agenda in funding opportunities around climate change)
- Capacity building and networking opportunities for early career researchers (access to infrastructure, working with real world systems and companies)
- Access to data and data sharing
  - o EPSRC could help with access to some data sets from local authorities.
  - o Data sharing policy should be implemented in the funding opportunities.
  - o Creation of collective standardised data, including longitudinal studies, on e.g., mould and air pollution (follow City of London open data set model - [Global City Data - London Datastore](#))
  - o Is there an equivalent of UK biobank for built environment? If not, funding opportunity to create data infrastructure would be beneficial.

### **What stakeholders should the engineering and physical sciences community be engaging with on this topic?**

- 1. UKRI and other funders**
  - Pan-UKRI activities
  - Innovate UK (Catapults, KTN)
- 2. Government and Policy Makers**
  - local authorities; local government associations
  - social housing providers
  - James Lind Alliance (NIHR) - consensus building and problem identification
  - NHS and Health Devolved Systems
    - o Academic Health Science Networks (AHSNs) - clinical networks
- 3. Industry**
  - housing/property developers
  - construction companies and builders
- 4. Charities, Associations, and Professional Organisations**
  - housing associations, care homes, retirement villages
  - Joseph Rowntree Foundation (and other policy think tanks)



- Royal Societies or Chartered Institutions
- Centre for Alternative Technology

#### **5. Public**

- end user groups, building users, design professions
- private housing owners (ageing of both people and housing)

#### **Needs:**

- stakeholders need to be involved from primary stages and throughout the whole research and innovation process
- PPIE groups should be identified at early stages (not just tokenistic engagement, but involving, co-creating, and participating with the public)
- Test beds (rapid-prototyping living labs): communities to test various ideas
- Addressing health inequalities
- Researchers to work with policy makers and providers (EPSRC to help facilitate these relationships)
  - Could part of the funding go to Local Authority so they can be seconded in this area?
  - There are a handful of local authorities that have funding for the research of health determinants of health research groups.
- Learning from other professions such as nursing

### **What types of activities and support would you like to see EPSRC deliver and be involved in to enable impactful research in this space?**

#### **1. Facilitate and enable cross-disciplinary collaboration and work with relevant partners**

- Engineering and Physical Sciences research on this topic should not be siloed, support and enable collaborative research with other disciplines e.g., social sciences
- Collaboration with other partners, both across UKRI and other funders/charities e.g. NIHR, AHRC, ESRC, James Lind alliance, UK Ageing Research Funders' Forum
- Networking events and workshops on themes/challenge areas within topic of EHE e.g., indoor environments, health inequalities
- Help co-develop 'challenges' and 'applications' with key stakeholders e.g., researchers, local authorities, charities, doctors, healthcare managers

- Facilitate collaborative conversations and engagement between academics/clinicians/NHS
- Facilitate and supporting interdisciplinary networking/match making across both sectors and disciplines.
- Support career development of ECRs going into cross-disciplinary research
- Support micro networks to facilitate cocreation and collaboration among relevant researchers and stakeholders. Facilitate the cocreation of research proposals.
- Engagement from the devolved administrations to understand health impacts/inequalities in different places e.g., the effect of fuel poverty/lack of insulation on different parts of the UK.
- Secondments to support policy development and work with policy makers

## **2. Funding schemes**

- Funding for networks/micro networks
- Sandpits – bringing in stakeholders outside academia
- EHE is a broad problem with many challenges, funding opportunities should have a specific focus to enable greater impact.
- Call focused on physical activity. Physical activity impacts a lot of different issues, including mental health. Call could be focused on *how we can use technology to help people be more active.*
- Call with a healthy ageing focus e.g., adapting ageing infrastructure for an ageing society
- Funding for co-design from the outset
- Work with other funders to support translation to higher TRL level

## **3. Peer review process**

- Assessment should include aspects of PPIE/co-creation/stakeholder participation/advocacy.
- Assessment panels for interdisciplinary research in this area should include non-academics and lay members to assess certain aspects of the proposals.
- Embed data sharing requirements into calls
- Require projects to involve community engagement/PPIE in all aspects of the research programme

## **4. Knowledge sharing and advocacy**

- Undertake advocacy and help increase the impact of research funded and help influence policy



- Help disseminate EPSRC research - platforms, events, online platforms.
- Support education around knowledge sharing with policy and decision makers