CARRii

The vision and missions of the
Centre for Applied Respiratory Research Innovation and Impact

Transforming Lung Health. Together.

Respiratory Disease Burden and Poor Health Outcomes in the UK - Background

Chronic respiratory conditions are highly prevalent in the UK, with 11.4 million people, approximately one in six, expected to develop a long-term respiratory problem during their lifetime [1]. Most prominent among these are asthma and chronic obstructive pulmonary disease (COPD) with asthma being the most common, affecting 5.4 million people [2].

The UK has some of the poorest health outcomes for respiratory disease in Europe, with the highest mortality rates for common respiratory conditions such as asthma and COPD in Western Europe [1,3]. Respiratory diseases account for 20% of all deaths in the UK [1].

> The persistently high disease burden leads to avoidable morbidity and mortality, as well as significant costs to the NHS and society.

Despite the availability of effective interventions, the situation is worsening. Asthma deaths rose by almost 25% in the 10 years following the publication of the National Review of Asthma Deaths (NRAD) in 2014 [4]. Compared to similar European high-income countries, the UK also has the worst mortality rates for asthma in children and young people aged between 10 - 24 years, and the second highest among 15- to 19-year-olds [5].

Respiratory conditions account for 8% of all hospital admissions and 10% of all inpatient bed-days [1,6]. Over the past 20 years, the number of respiratory admissions in England and Wales has doubled [7]. During the winter months, these admissions can double again, highlighting how respiratory diseases significantly contribute to NHS winter pressures [8]. This results in approximately 6 million patient bed-days and over 700,000 hospital admissions annually, most of which are unscheduled emergencies [8]. The economic burden is substantial, with asthma and COPD costing the NHS £3 billion and £1.9 billion respectively. In total, lung conditions cost the NHS around £11 billion annually with much higher costs to society through loss of productivity, early retirement and premature mortality [9].

Evidence indicates that during winter the NHS faces increased demands driven by the coincidental peak of multiple respiratory infections, including Respiratory Syncytial Virus (RSV), Flu, and COVID-19 [10]. These infections can severely impact vulnerable populations including children, the elderly and individuals with chronic respiratory diseases, such as asthma and COPD, and those with underlying heart problems.

In the winter, exacerbations of these chronic conditions become more frequent, particularly due to viral infections, cold weather and other environmental factors. These seasonal increases put added strain on already stretched NHS resources, including bed capacity and staffing, which threatens the NHS's ability to manage, leading to the all too annual familiar winter crises.

Adding to the challenge is the fact that disadvantaged populations are most impacted, reflecting the strong link between socioeconomic inequality and respiratory disease. People in the UK's poorest communities are seven times more likely to die from a respiratory condition, with 70% of those with asthma experiencing uncontrolled symptoms [11,12]. Furthermore, disadvantaged populations are disproportionately exposed to polluted air, despite contributing the least to its creation [13].

Despite the wide prevalence and both the individual and societal costs of respiratory conditions, only 2.5% of government and charity research funding is dedicated to respiratory health [14].

The Case for Change

These stark facts demonstrate the need for a renewed focus on driving change, particularly to address the disease burden, escalating costs on the NHS and inequalities associated with respiratory disease.

The 2024 NHS Review led by Lord Darzi, highlighted three key areas which could rapidly improve the NHS: greater emphasis on prevention, movement of more services into the community and the transformation from an analogue to a digital system.

To make this happen, there is a need for novel, collaborative and transdisciplinary approaches across the spectrum from research to clinical practice. It is unacceptable that in the 10 years following the publication of the NRAD, which concluded that the majority of asthma deaths could be prevented, a further 12,000 people in the UK have died from asthma attacks [15]. This Review identified several key factors contributing to two-thirds of analysed asthma deaths which were deemed preventable.

These included inaccurate diagnoses, inappropriate prescribing, healthcare professionals' failure to identify and act on risk factors and the lack of personal asthma plans to support self-management and education. Developing systems and tools to support accurate diagnosis, risk identification, care optimisation and increased adoption of self-management education could dramatically reduce the number of asthma deaths [16].

The establishment of an integrated UK-wide applied research, innovation and implementation centre of excellence, has the potential to transform, innovate and improve respiratory health outcomes through fostering cohesive, collaborative networks across the respiratory ecosystem. It would build strong connections between academia (including applied researchers, health data scientists, and behavioural scientists from various disciplines), industry, NHS healthcare providers, social care services and individuals living with respiratory diseases.

Against this background, the Centre for Applied Respiratory Research, innovation and impact (CARRii), has been created. It is at the forefront in driving change through uniting and galvanising the UK's applied respiratory community. CARRii will work to promote and lead high quality applied research and also drive the implementation of evidence-informed care to transform UK respiratory health outcomes, bringing the benefits of science to people living with respiratory disease.

To Achieve our Vision and Missions, CARRii will:

- Strengthen links between academia and industry to address key respiratory research priorities, informed by people with lived experience.
- Focus on supporting the implementation of research outputs.
- Raise awareness of and drive solutions to the prevailing and deepening disparities in respiratory health outcomes.

Moreover, CARRii is uniquely placed to facilitate collaboration between cutting-edge industry innovators, health data scientists, behavioural scientists, people with lived experience and policymakers.

Building on the strong foundations laid by its predecessor, the Asthma UK Centre for Applied Research (AUKCAR), CARRii will broaden its network, enhance expertise and increase capacity to advance applied respiratory research, innovation and impact. By adopting innovative approaches, CARRii aims to drive transformative change and improve respiratory health outcomes. This will be achieved by a core focus on translating research outputs into practice, ensuring that cutting-edge discoveries translate into meaningful improvements in respiratory health.

This White Paper sets out CARRii's vision and initial missions to improve the UK's poor respiratory health outcomes. It delivers a call to action for stakeholders to support and participate in efforts to significantly reduce respiratory deaths, alleviate the burden of unscheduled care on the NHS and to address respiratory health inequalities.

The Game Changer

CARRii is a UK network of world-leading academics, clinicians and industry partners collaborating with lived-experience colleagues. Our virtual Centre is committed to improving the diagnosis, treatment and care of people living with respiratory conditions.

CARRii's Growing Academic Partners

CARRii's research focuses on developing, testing and implementing interventions and programmes that have the potential to achieve substantial, sustained reductions in respiratory morbidity, mortality and inequalities.

CARRii is uniquely positioned to translate applied respiratory research into meaningful policy and practice change by bridging the gap between science and delivery of care. Building on the decade of experience of its forerunner, AUKCAR, CARRii will bring multidisciplinary collaboration and vision to connect the UK's respiratory communities.

By translating research into clinical practice, reducing the fragmentation of health data and harnessing the power of technology and digital solutions, CARRii aims to drive significant improvements in respiratory health.

Vision

CARRii's vision is to transform UK respiratory health outcomes by connecting people with lived experience, research communities, the life sciences industry, health technology innovators, educators and policymakers. Its goal is to reduce morbidity and mortality from respiratory disease through the implementation of research into clinical practice and the adoption of innovative approaches to improve diagnosis and management.

CARRii's targets align with Asthma & Lung UK's objectives to deliver the following [17]

A 20% reduction in hospitalisations for asthma, COPD and respiratory tract infections.

A 20% reduction in health inequalities associated with respiratory outcomes [17].

Mission Driven

CARRii will adopt a mission-driven approach, aligning its objectives with a clear and focused purpose. Inspired by the government's current mission-driven strategies, CARRii will actively contribute to the overarching mission to:

Build an NHS fit for the future, ensuring timely care for all, reducing lives lost to major health challenges, and creating a fairer Britain where everyone can live healthier and longer lives.

This alignment emphasises CARRii's commitment to impactful research and actionable solutions that address healthcare inequalities, improve outcomes and meet the evolving needs of patients and society.

The UK Office of Life Sciences 10-year vision clearly highlighted reducing morbidity and mortality from respiratory disease as one of seven healthcare mission priorities [18]. It identified the better use of health data to increase the efficiency and delivery of clinical research as a way of improving healthcare outcomes and stressed the importance of a joined-up infrastructure to improve respiratory outcomes. Although the focus of this vision has now changed, we believe these underpinning factors remain the same. CARRii will stimulate a UK wide applied respiratory research community, working with industry partners (e.g. pharmaceutical, small and medium enterprises, biotech, digital and wearables companies) to innovate against a backdrop of whole-population analysis of respiratory data. This will drive a better understanding of both the prevention of respiratory disease and how best to implement research findings into clinical practice.

The UK's data infrastructure from primary and secondary health and social care data are uniquely positioned to facilitate whole population analysis. For example, a collaboration with Health Data Research (HDR) UK during the COVID-19 pandemic demonstrated that the UK's health data environment has the potential to support whole UK population analyses [19].

CARRii's vision focuses on a rolling programme of respiratory missions to transform UK respiratory health outcomes. This will be achieved by tackling the causes of preventable respiratory diseases, increasing the adoption of self-care strategies and making major inroads into improving care delivery through a specific focus on applied outcomes.

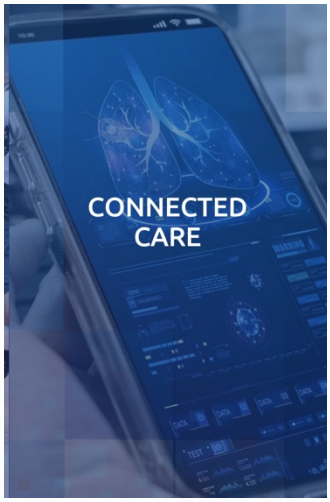
Mission 1:

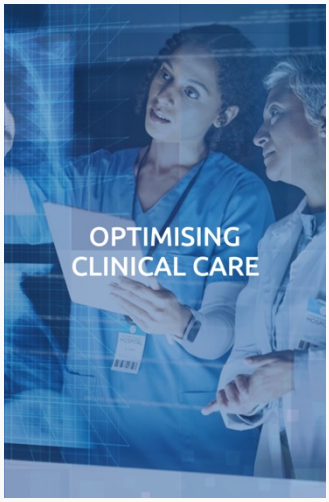
To Reduce Annual NHS Winter Pressures

To reduce annual NHS winter pressures by decreasing the need for unscheduled respiratory care. Initially, CARRii will focus on three themes which aim to reduce the burden of unscheduled respiratory care:

Theme 1: Reducing Risk & Infections – Improving and evaluating vaccination uptake, evaluating new respiratory virus threats, testing interventions to address poor air quality and other environmental causes of respiratory disease, such as poor housing, smoking and youth vaping.

Theme 2: Connected Care – Our ambition is to keep people out of hospital through better supported self-care. We believe that realising the potential of digital technology to generate data and personalised approaches to promote self-management and risk reduction will help to keep people out of hospital, reduce length of stay and facilitate early discharge.





Theme 3: Optimising Clinical Care – Precision medicine using new biomarkers and artificial intelligence's potential to improve both earlier diagnosis and risk stratification presents huge opportunities to target treatment and optimise organisation of clinical care. CARRii will deliver studies exploiting these opportunities to improve respiratory outcomes and facilitate their widespread adoption.

Mission 2:

To Reduce Respiratory Health Inequalities

Health inequalities have long been a striking feature of respiratory diseases in the UK [20]. The UK Government's focus on the prevention of ill health provides a welcome policy landscape following the publication of Lord Darzi's report on the state of the NHS in England [21,22] . Reduction of health inequalities is a major task requiring wide societal and economic change.

Whilst these are beyond the remit of CARRii, the Centre can make important contributions. For example, a key driver of respiratory inequalities are the twin environmental exposures of poor air quality and cigarette smoking. CARRii will pursue evaluations that mitigate the harms of these exposures to reduce health inequalities.

CARRii will:

- Influence the impact of research evidence in such a way as to decrease health inequalities.
- Make health inequality assessments a feature of all CARRii's outputs.
- Foster meaningful and targeted stakeholder engagement to facilitate policy and practice change to ensure widespread adoption of evidence-based interventions.

To achieve these missions, CARRii will adopt a broad interdisciplinary approach, engaging with a variety of experts from diverse specialities to foster innovative thinking to develop new solutions.

Capacity for Change Built on a Unique Heritage

CARRii will harness expertise from across the UK and catalyse collaboration to increase investment in respiratory research and its application. This capability stems from its unique heritage - continuing the momentum built on the foundation of its forerunner, AUKCAR.

Since its inception in 2014, AUKCAR, with its aim to improve the lives of people with asthma, delivered on its promise and created a new generation of asthma researchers and a large programme of patient public involvement.

AUKCAR attracted over £83 million of funding into asthma research and published over 800 scientific publications that increased the profile, standing and output of the asthma research community. AUKCAR [23] also:

- Engaged more than 120 members in the Centre's patient and public involvement group.
- Trained the next generation of asthma researchers, with over 50 doctoral students and research fellows supported.
- Established a unique collaborative research environment of over 22 academic, NHS and other collaborative institutions across the UK.
- Made a significant contribution to the Government's response to the COVID-19 pandemic.

Despite these successes, following an internal review of the impact of AUKCAR, it became apparent that greater investment is needed to ensure that research is translated into practice and policy change and results in improved outcomes. That is where the new Centre will focus more attention and work with a wider range of stakeholders, including NHS providers and commissioners of care to;

'Transform Lung Health. Together'.

CARRii will drive the adoption of best practice. This will be achieved by influencing policy changes, training and embedding researchers in clinical settings, linking with commercial partners to support innovative approaches and working with Health Innovation Networks and the NHS. CARRii will ensure that patients remain at the heart of its work and will be informed by a network of over 150 public and patient members.

CARRii's Goal

CARRii's goal is to generate outputs that will have a direct impact on people with respiratory conditions. To do this, it will influence:

- Policymakers in the UK and the devolved nations' Parliaments.
- Industry partners to innovate and develop health-based technologies using artificial intelligence to improve risk stratification and earlier and more accurate diagnosis.
- Clinical practices through contributions to guideline development groups and training materials for healthcare professionals.
- Infrastructures, resources and access to cutting-edge methodological expertise.
- Programmes of applied research.
- A pipeline of future applied respiratory researchers and respiratory patient advocates with the knowledge, skills and capacity to lead change.

CARRii will also spearhead opportunities provided by integrating health data across the NHS, industry and academia through collaborative working with organisations such as HDR UK and NHS Digital. Uniting the UK's health data will create a unique platform for unlocking discoveries that improve the lives of people with respiratory conditions.

Conclusion

Although COVID-19 enhanced the world's perception of the importance of respiratory medicine and the impact of innovative approaches, the extent of respiratory disease morbidity and mortality remains under-appreciated.

The future of respiratory medicine will continue to rely on advancements in science, clinical trials and enhanced investments in technology and data science. These innovations will drive collaborations aimed at translating research into clinical practice, ultimately improving outcomes for individuals affected by respiratory conditions.

CARRii has the experience, expertise, relationships and infrastructure to be a critical force in transforming respiratory outcomes. However, it needs investments built on multi-stakeholder and cross-sector collaboration to help make the UK a respiratory research superpower through partnerships that meaningfully improve lives.

CARRii will rise to this challenge over the next 10 years. It will enable research informed by those with lived experience, networks, links with industry, patient advocacy and increased engagement with policymakers and will increase funding to have influence on respiratory health outcomes.

Call to Action

Join us on our journey to transform UK respiratory health outcomes. We aspire to collectively raise £150 million over the next 10 years to support this transformation through a combination of research grants, charity and philanthropic donations and industry collaborations, alongside a wide range of in-kind support.

The key enabler for this vision is the willingness to collaborate, be transparent and open and embrace our diverse interdisciplinary approach to drive change together.

Meet the CARRii Executive Team

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