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Born in Bradford Breathes: evaluating the health, air quality and economic impact of a city wide intervention to improve air quality

Submission date
13/05/2020

Recruitment status
No longer recruiting

Registration date
06/07/2020

Overall study status
Ongoing

Last Edited
19/02/2025

Condition category
Respiratory

[X] Prospectively registered
[X] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
The UK has high levels of air pollution, which costs the NHS and society around £20 billion a year. Poor air quality is a major cause of early death and illness. It has been linked to lung and heart disease in children and adults and low birth weight. During periods of poor air quality, health gets worse, leading to more hospital admissions and deaths. Children and the elderly are particularly affected by pollution. Poorer areas of the country have worse air quality and this increases inequalities in health. Thirty three local councils with high pollution levels have to put in place air quality plans which include Clean Air Zones. Bradford will introduce a Clean Air Zone in 2021 in order to reduce pollution using policies such as charging people for driving polluting vehicles. However, there is little evidence whether these policies improve air quality and health and what effect they might have on health inequalities.

The aim of the study is to evaluate the impact of a Clean Air Zone on air quality, health and health inequalities in the city of Bradford.

Who can participate?
People living within Bradford District.

What does the study involve?
We will explore changes in air quality in the city using regularly collected data that is already available on air pollution and will also collect additional data from 12 schools throughout the city. In addition, 240 children in these schools will help us collect data by using mobile air sensors for three months before the Clean Air Zone is put in place and for three months in the year after. The impact on lung, heart health and birth weight will be measured by comparing the health of over 500,000 Bradford residents in the three years before and three years after the Clean Air Zone is in place. The research will examine whether the impact is different for people from more deprived areas or different ethnic groups. This will use detailed information collected on 13,500 children who are part of the Born in Bradford study. We will look at whether the policy changes the way people choose to travel by conducting a survey with 4000 families. We will also conduct group discussions and interviews with key groups of people including businesses, transport

companies, families, and pedestrians. These discussions will explore what may have helped or hindered the success of the policy and any unexpected effects. We will also explore if the Clean Air Zone is good value for money, e.g. do any improvements in health justify the costs.

What are the possible benefits and risks of participating?
This study will use anonymised routinely collected health data from residents living in Bradford collected before and after the B-CAP is implemented. As such there are no direct risks of taking part. To explore the impact of the B-CAP on air quality Primary school children will also be asked to carry portable air quality sensors in the year prior, and year following B-CAP implementation. We do not forsee any risks with taking part in this part of the study. In return we will work with participating schools to develop curriculum based air quality research materials which we hope will inspire learning in science related subjects.

Patient/Public Involvement
100 community members and two schools have been involved in developing our proposal and thinking about how to test if the policy will work and what effect it will have on the residents of Bradford. We have also worked closely with Bradford council and the UK Government department responsible for air quality nationally (DEFRA). Community, school and local authority representatives are part of our study team. They will be actively involved in the development and management of our research. DISSEMINATION: We will share our findings widely using a range of approaches depending on the audience. Researchers, policy and decision makers will receive academic papers, policy briefings, and be invited to events. We will communicate our research with communities through a series of short 'in a nutshell' reports publicised widely through social media channels, local media links, and engagement events. We will also develop materials for schools based on our findings to inspire and inform the next generation of researchers.

Where is the study run from?
Bradford Institute for Health Research (UK)

When is the study starting and how long is it expected to run for?
July 2020 to June 2026

Who is funding the study?
National Institute for Health Research (NIHR) (UK)

Who is the main contact?
Prof. Rosie McEachan (scientific), rosie.mceachan@bthft.nhs.uk
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Contact information

Type(s)
Scientific

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Public

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Additional identifiers

EudraCT/CTIS number
Nil known

IRAS number
281405

ClinicalTrials.gov number
Nil known

Secondary identifying numbers
IRAS 281405

Study information

Scientific Title
Evaluating the life-course health impact of a city-wide system approach to improve air quality in Bradford, UK: A quasi-experimental study with implementation and process evaluation

Acronym
BiB Breathes

Study objectives

Aims and research questions:
We aim to assess the impact of the Bradford Clean Air Plan (B-CAP, including a charging Clean Air Zone) on attitudinal, behavioural, air pollution and health outcomes, and its cost-effectiveness, using a multi-outcome, multi-sector approach. We also aim to explore the factors influencing any impact (or lack of) and explore unintended or unanticipated outcomes. The impact of the B-CAP on health inequalities amongst different socio-economic and ethnic groups will be assessed across all outcomes.

Research Questions:
1. What are the key barriers and enablers to implementation of the B-CAP (including acceptability), and are there unintended consequences of the B-CAP for different stakeholder groups (e.g., increased health and economic inequalities)?
2. Does the B-CAP affect travel choice behaviour and attitudes amongst Bradford residents at 12 months post implementation?
3. Does the B-CAP reduce exposure to pollution amongst primary school age children up to 12 months post implementation?
4. What is the impact of the B-CAP 3 years post-implementation on:
4.1. Respiratory health (primary outcome, as assessed by weekly counts of respiratory disease related emergency hospital or General Practice [GP] attendance) of children (aged <18), adults (aged 18-64) and older adults (aged 65+)
4.2. Cardiovascular health (as assessed by weekly counts of cardiovascular disease related emergency hospital/GP attendance) of adults and older adults
4.3. Birth outcomes such as low birth weight and preterm birth (assessed by monthly counts)
5. How does the B-CAP impact on health inequalities up to three years post implementation?
6. What is the value for money of the B-CAP three years post-implementation and longer term?

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 30/06/2020, Bradford Leeds (Yorkshire and the Humber) NHS Research Ethics committee (The Old Chapel, Royal Standard Place, Nottingham, NG1 6FS, UK; +44 (0)207 104 8018; bradfordleeds.rec@hra.nhs.uk), ref: 281405

Study design
Quasi-experimental interrupted time series design

Primary study design
Other

Secondary study design

Study setting(s)
Community

Study type(s)
Prevention

Participant information sheet
Not available in web format, please use contact details to request a participant information sheet.

Health condition(s) or problem(s) studied
Respiratory health, cardiovascular health, birth outcomes

Interventions
The Bradford Clean Air Plan

In order to address illegal levels of pollution within the City, Bradford Council have been directed by the UK Government to develop and implement the Bradford 'Clean Air Plan' (B-CAP). With a planned implementation date in late 2021, the plan includes a range of activities designed to reduce concentrations of nitrogen dioxide within the city to legal levels as soon as possible.

The B-CAP will include a charging clean air zone (CAZ) class 'C' (targeting non-compliant taxis, buses, heavy goods vehicles [HGVs], and light goods vehicles [LGVs]) Daily charges will be £12.50 for taxis, £9 for LGVs and £50 for HGVs. Exemptions will be provided for local small/medium enterprises (SMEs), schools and charities. The Bradford ambition is for the CAZ to be supported by a range of other activities/components including: Electric bus routes in key parts of the city with road space allocation to prioritise buses and reduce journey times; grants to retrofit polluting buses to CAZ standards; introduction of clean air standards for all Taxis registered in Bradford so only compliant vehicles can operate; grants and incentive schemes to encourage i) taxi drivers to upgrade to minimum CAZ standards (hackney carriages), petrol/hybrid (private hire vehicles), or electric (both), ii) HGV, LGV, Coach and minibus owners to upgrade to minimum CAZ standard; new park and ride facilities for up to 1000 vehicles /day; installation of alternative energy centre providing cost effective green refuelling/recharging facilities; travel planning with businesses to promote car sharing, active travel and public transport use amongst employees); and an engagement programme to encourage a reduction in polluting heating sources with the CAZ boundary.

We will explore changes in air quality in the city using regularly collected data that is already available on air pollution and will also collect additional data from 12 schools throughout the city. In addition, 240 children in these schools will help us collect data by using mobile air sensors for three months before the Clean Air Zone is put in place and for three months in the year after. The impact on lung, heart health and birth weight will be measured by comparing the health of over 500,000 Bradford residents in the three years before and three years after the Clean Air Zone is in place. The research will examine whether the impact is different for people from more deprived areas or different ethnic groups. This will use detailed information collected on 13,500 children who are part of the Born in Bradford study. We will look at whether the policy changes the way people choose to travel by conducting a survey with 4,000 families. We will also conduct group discussions and interviews with key groups of people including businesses, transport companies, families, and pedestrians. These discussions will explore what may have helped or hindered the success of the policy and any unexpected effects. We will also explore if the Clean Air Zone is good value for money, e.g. do any improvements in health justify the costs.

Intervention Type
Other

Primary outcome measure
Respiratory health of Bradford residents (as assessed by weekly counts of respiratory disease related emergency hospital or General Practice [GP] attendance) of children (aged <18), adults (aged 18-64) and older adults (aged 65+) at three years post implementation of the B-CAP

Secondary outcome measures
1. Cardiovascular health of Bradford residents (as assessed by weekly counts of cardiovascular disease related emergency hospital/GP attendance) of adults (aged 18-64) and older adults (aged 65+) assessed three years post implementation
2. Birth outcomes of babies born within Bradford such as low birth weight and preterm birth (assessed by monthly counts) assessed three years post implementation
3. Air quality (Nitrogen Dioxide, Particulate matter) collected using routine and bespoke monitoring assessed one year post implementation.

From the process and implementation evaluation:
4. Intervention fidelity, adaptations, barriers and enablers to implementation, acceptability, adverse/unintended consequences, travel mode behaviour and attitudes assessed one year post implementation

From the economic evaluation:
5. Key economic outcomes include healthcare resource use and costs, quality adjusted life years, distributional effects assessed 3 years post implementation

Overall study start date
01/07/2020

Completion date
30/06/2026

Eligibility

Key inclusion criteria
Living within Bradford District

Participant type(s)
All

Age group
All

Sex
Both

Target number of participants
Using an existing routine data set of 500,000 Bradford residents.

Key exclusion criteria
Participants who move out of Bradford district during duration of the study.

Date of first enrolment
15/03/2021

Date of final enrolment
20/01/2025

Locations

Countries of recruitment
England

United Kingdom

Study participating centre
Bradford Institute for Health Research
Bradford Teaching Hospitals NHS Foundation Trust
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Sponsor information

Organisation
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Sponsor type
Hospital/treatment centre

Website
https://www.bradfordhospitals.nhs.uk/

ROR
https://ror.org/05gekvn04

Funder(s)

Funder type
Government

Funder Name
Public Health Research Programme

Alternative Name(s)
NIHR Public Health Research Programme, PHR

Funding Body Type
Government organisation

Funding Body Subtype
National government

Location
United Kingdom

Results and Publications

Publication and dissemination plan
Current publication and dissemination plan as of 30/10/2024:
Interim analyses, including interim health effects (one year post implementation) and process /implementation findings planned for winter 2024.
Full analyses, including primary and secondary health outcomes and health economic analysis (three years post implementation) planned for June 2026.

Previous publication and dissemination plan:
Interim analyses, including interim health effects (one year post implementation) and process / implementation findings planned for July 2023.
Full analyses, including primary and secondary health outcomes and health economic analysis (three years post implementation) planned for June 2025.

We will develop bespoke dissemination, knowledge exchange and impact plans for our key stakeholder groups. For National (DEFRA; Public Health England; NICE; Local Government; Clean Air Groups; Active Travel groups) and regional (local authorities, schools) stakeholders, we will produce policy and parliamentary briefing notes, plain English summaries and hold dissemination events. For academic audiences, we will publish our findings in high impact open access journals and present at relevant national and international conferences.

We have an exciting opportunity to disseminate our findings creatively to families and children. Building on our school based citizen science air quality monitoring, we will work closely with teachers to develop school based curriculum materials which will allow pupils to assemble bespoke low cost air quality monitors using the Raspberry Pi microcomputers and use these to develop and evaluate their own local initiatives to improve air quality. Our curriculum materials, which will be developed in close partnership with co-applicants will provide pupils with a range of hands-on research experience including coding, comparing data from multiple sensors (accuracy), measuring, formulating research questions, designing interventions, evaluating interventions, and reporting results. We will develop a web data dashboard allowing citizen scientists to view their air quality measurements on an interactive map, and compare with other areas. We hope to use these materials as a springboard to engage pupils, particularly from

disadvantaged backgrounds, to engage in science, technology, engineering and mathematics (STEM) learning. We will hold engagement events with parents and teachers from participating schools outside of intensive measurement periods to raise awareness of issues related to air quality.

Intention to publish date
30/06/2026

Individual participant data (IPD) sharing plan
The current data sharing plans for this study are unknown and will be available at a later date

IPD sharing plan summary
Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Protocol article		05/12/2022	05/12/2022	Yes	No
Results article		28/06/2023	14/08/2023	Yes	No
Results article		01/07/2023	14/08/2023	Yes	No
Other publications	Qualitative study	25/05/2024	30/10/2024	Yes	No
Results article	Health and nitrogen dioxide	28/01/2025	19/02/2025	Yes	No
Results article	Process and implementation evaluation	15/11/2024	19/02/2025	Yes	No