"We care about clean air": harnessing school-age citizen scientists to identify patterns of exposure to pollution and co-producing opportunities for change

Introduction

- School children are exposed to high levels of pollution during the school journey
- We co-produced, implemented, and evaluated interventions in four schools in Bradford, UK, and Barcelona, Spain to reduce exposure to air pollutants on the school journey

Methods

- Co-production workshops in each school with pupils, teachers, parents, and local stakeholders were conducted to identify concerns and develop tailored interventions

Bradford interventions included: Alternate routes to school| walking buses | information campaigns on idling cars and air pollution

Barcelona interventions included: Alternate routes to school | citizen action—writing to the local government for commitments to improve the school environment | information campaigns about road safety | NO_2 monitoring at school entrances and exits

- Interventions were implemented June-July 2022
- N=40 pupils (n=20 Bradford; n=20 Barcelona) carried personal air quality sensors (Atmotube Pro), GPS smartphones, and NO_2 diffusion tubes for one week prior to the intervention implementation and one week post-implementation
- Change in exposure was examined using Generalized Linear Models separately for the morning and afternoon travel periods for all children with data
- Sensitivity models were run in Bradford for children known to have changed their routes based on GPS mapping

Results

- No changes in $PM_{2.5}$ and PM_{10} were observed among Bradford or Barcelona children from pre- to post-intervention

	$PM_{2.5}$ (µg/m³) (95% CI)*		PM_{10} (µg/m³) (95% CI)*	
	All	Alternate route	All	Alternate route
	Bradford‡			
Morning	1.7 (-1.0 , 4.4)	1.8 (-2.8, 6.5)	1.7 (-1.0, 4.5)	1.8 (-2.9, 6.5)
Afternoon	0.8 (-4.1, 5.7)	-3.1 (-13.1, 6.9)	0.68 (-4.6, 5.9)	-3.5 (-14.4, 7.5)
	Barcelona‡			
Morning	-1.6 (-5.6, 2.4)	-	-1.6 (-5.6, 2.4)	-
Afternoon	-2.1 (-4.9, 0.7)	-	-1.8 (-4.9, 1.3)	-

*reference is pre-intervention; ‡ All (n=18) both schools; known route change (n=7); ‡All (n=10) one school shown. Only one school changed routes and GPS data was missing, precluding analysis of children with known route changes

The **school journey** is a **source** of exposure to **air pollutants**

Interventions to reduce exposures can be **co-produced** but **meaningful reductions** require **structural** changes **in addition** to individual behavioral change

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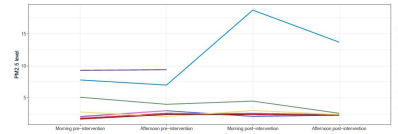
Children are often exposed to air pollution beyond the World Health Organization limit (5 µg/m³)

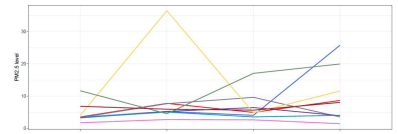
Bradford

Patterns of $PM_{2.5}$ (µg/m³) concentrations averaged across the morning (7-9am) and afternoon (3-5pm) travel period

School 1

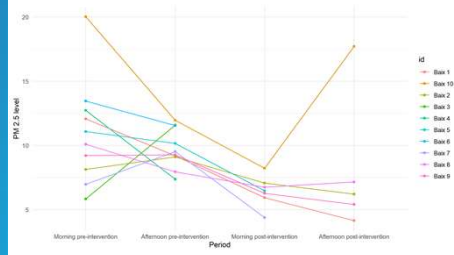


School 2



Barcelona

Patterns of $PM_{2.5}$ (µg/m³) concentrations averaged across the morning (7-9am) and afternoon (4-7pm) travel period
Note: second school not shown



Discussion

- We did not find a change in children's exposures from pre- to post-implementation of interventions; many children had missing data for one or more periods or did not follow the intervention (for example: taking an alternate route)
- Interventions selected were restricted by what could be feasibly implemented
- Schools in both sites desired interventions which were unable to be implemented because they required further support and resources, such as closing down roads during school drop-off times (School Streets), bicycling safety courses, or increased green space around schools

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