

## Tree planting, air quality, global warming and their exponential impact on allergic rhinitis (AR) and asthma

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BACKGROUND



Incidences of allergic rhinitis (AR) and asthma have increased significantly in the last 30 years (2,3).

Coincidentally, birch (*Betula* spp) has been mass planted in urban areas, expanding the leaf canopy, with the intention to mitigate pollution.

HM Government's document 'Moving More, Living More' (4), and Department of Education (DfE) statutory guidance on sustainable travel (5), promote walking to school to increase physical activity in children, and more broadly to improve public health.



### OBJECTIVES

- To raise awareness of why planting allergenic birch trees in urban areas may increase AR and asthma in children by greater exposure to the airborne pollen.
- This poster focuses on birch, one of the most allergenic species currently planted in streets, school playgrounds and urban gardens.

### METHODOLOGY

- Literature and web search
- Clinical and scientific evidence sourced from a) hospital admission data, b) incidence of AR and asthma in children, c) morphological traits of different tree species, and d) low pollen planting initiatives.

RESULTS

## Pollen facts

### Birch: most popular street tree

- Aesthetic – beautiful bark and dappled light cast by leaves
- Recommendation as biofilter in Lancaster University study – disseminated by the media (6)
- Economy – inexpensive tree to buy; light leaf fall generates little street litter
- Health and wellbeing – e.g. NHS Forest (7) and hospice gardens
- Lack of knowledge of pollen allergies and health implications (8)

### Pollination

Birch pollen is anemophilous (airborne, dispersed by wind). It is light and fine.

By contrast, entomophilous pollen (dispersed by insects) is usually heavier and stickier, thus less likely to become airborne and cause respiratory allergy.



Male and female birch catkins

### Sexual significance

Pollen is the male DNA of the plant world. Birch, like alder and hazel, is monoecious – i.e. male and female flowers appear on the same plant.

Some other species are dioecious – i.e. individual plants are either male or female. Only the male plants produce pollen. Thus female clones should be used in higher ratios in low pollen planting schemes (9, 10, 11).

### Pollen grain size

Pollen grains measure  $PM_{10}$  and larger. On contact with humidity and warmth, pollen grains rupture into much smaller particles (12).  $PM_{2.5}$  particles can easily penetrate the pulmonary alveoli (13).

### Birch pollen season

- The National Pollen and Aerobiology Research Unit (NPARU) calendar indicates that airborne birch pollen is present from March to May, depending on the weather (14).
- Pollen captured on children's hair and clothes and taken indoors can extend the period of exposure by up to 2 months (15).

## Environment

### Urban impacts of climate and culture

- Anthropogenic correlation** between increase in carbon emissions and airborne pollen (17,18)
- Ecoservices:** more trees in green infrastructure (GI) to mitigate global warming and pollution (19)
- Disservice** of excessive allergenic tree pollen (20)
- Hard landscaping:** pollen circulates in wind tunnels and enclosed spaces, heightening exposure as pollen is not absorbed into hard surfaces (21)
- Fashion influencing epidemiology:** birch monocultures (22)

### Many low allergy alternatives to birch

- Of 2951 vascular plants listed in The New Atlas of British Flora, very few trigger respiratory allergy
- Birch, together with alder and hazel, predominate in NPARU's pollen traps (23)
- Many low allergy trees have foliage suitable to capture  $PM_{2.5}$

### Avoid allergenic pollen: the 1st principle

Worldwide examples of preventative solutions to minimise exposure to allergenic pollen:



- US** Albuquerque, New Mexico – Cypress (*Cupressus* spp) and Mulberry (*Morus* spp) designated as restricted plants (24)
- JO** Amman, Jordan – Olive (*Olea europaea*) – flowering trees banned from the city (25)
- DK** Aarhus, Denmark – Birch (*Betula pendula* and *B. pubescens* (syn. *B. alba*) no longer planted in public spaces and highways (26)
- NZ** Christchurch, New Zealand – First plantings of non-native Birch, as a street and school playground tree, gave rise to significant incidence of Birch allergy (27)
- DE** Cologne, Germany – Website tool to aid tree species selection includes allergenicity in criteria (28)
- GG** Guernsey – Low allergen plant nursery and educational workshops for schoolchildren and families on low allergen gardening (29)
- CA** Marydale Park, Canada – Low allergen forest planted for healthier recreational use (30)
- IT** Milan, Italy – Newly introduced birch recognised as unprecedented allergy trigger (31)

## Children's health

### UK statistics

- 3rd highest rate of AR in the world (32)
- The highest rate of asthma in the world (33)

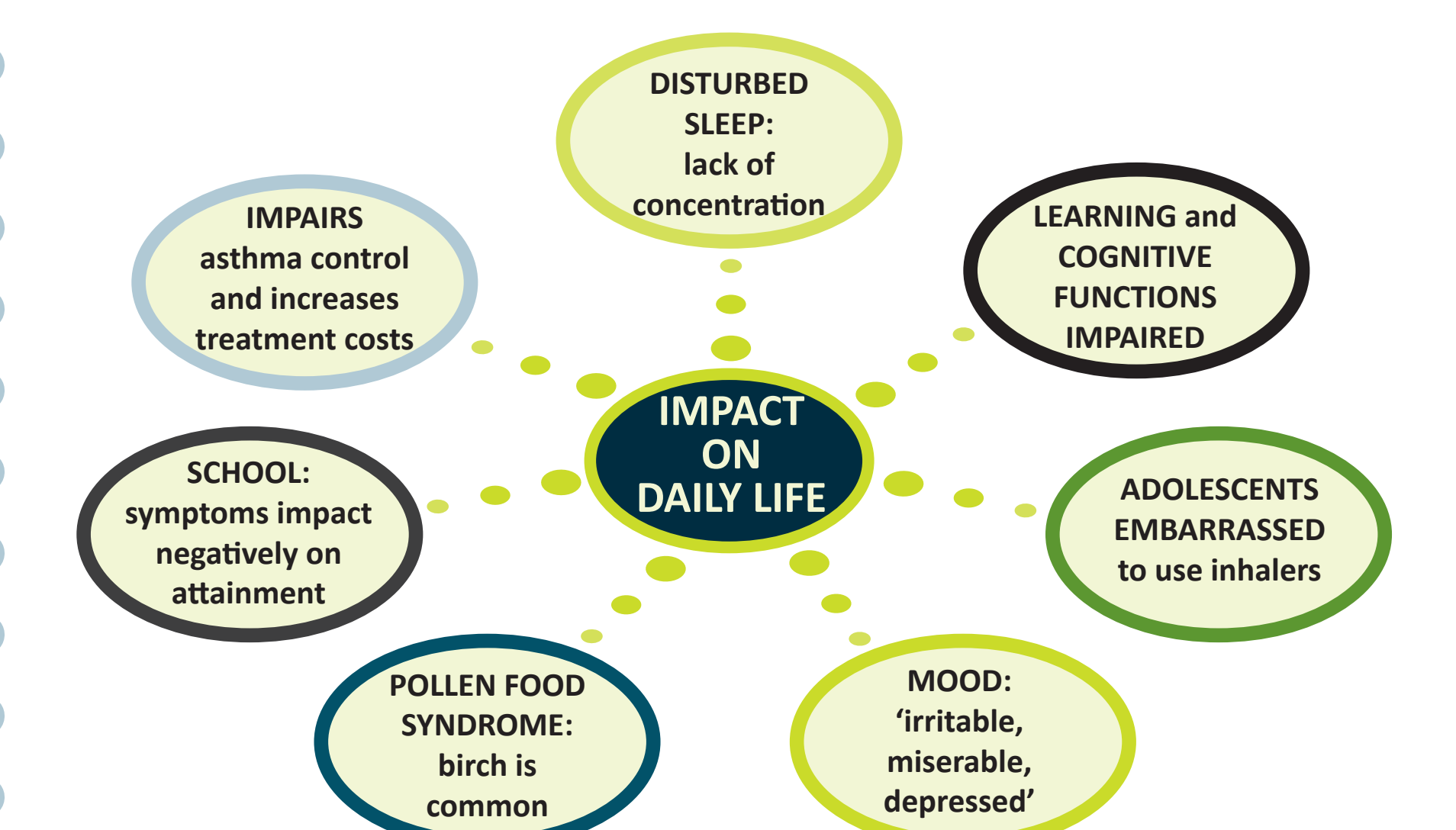
### Proven link between pollen allergy and asthma

- 80% of asthmatics also have a pollen allergy
- Allergies trigger asthma exacerbations in up to 90% of children with asthma (34)

### Pollen Food Syndrome

- Birch, alder and hazel are common triggers
- 7% children vs. 2% adults are susceptible to food allergies.
- In Central Europe up to 70% of patients allergic to birch and alder pollen show symptoms of allergy to plant foods (35)

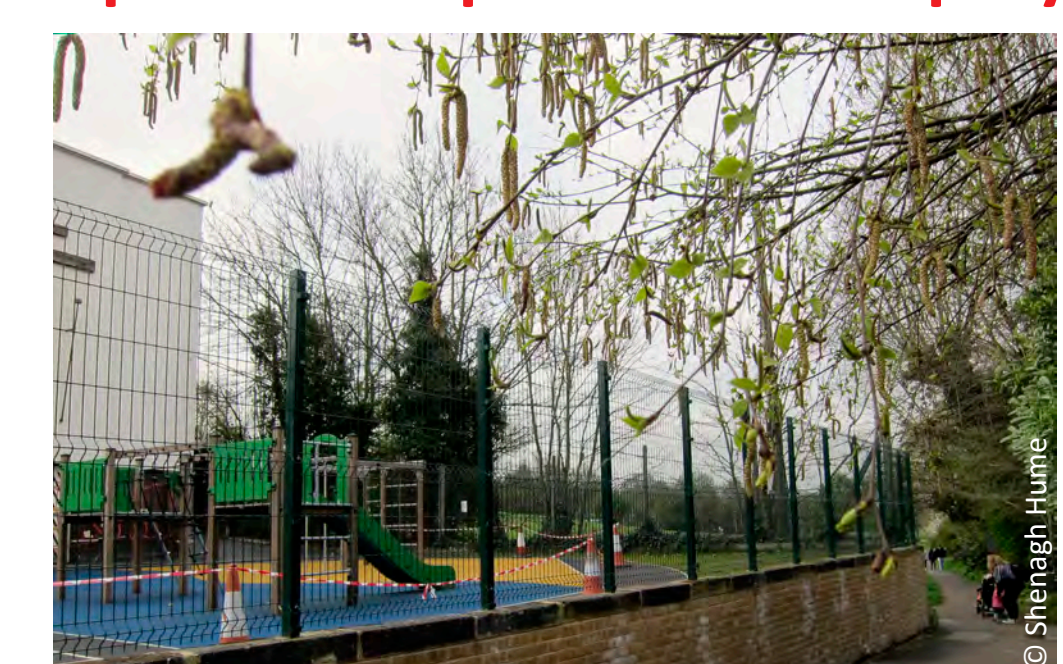
### Impact of pollen allergy on daily life (36, 37,38)



### Proximity pollinosis

- Neo-natal exposure increases the risk of allergy (39)
- Birch pollen data (1 March to 10 June 2002-2012) from Armonk, New York established significant associations with over-the-counter allergy medication sales and daily asthma syndrome Emergency Department (ED) visits. Associations were strongest in children aged 5-17. (40)

### Repeated exposure to pollen in the playground



## Discussion

- Birch, the so-called "Tree of Life", is being planted without awareness of its allergic potential.
- The symptoms of AR can cause considerable morbidity in physical and emotional impact as well as the functional capacity of daily life.
- School Travel Plans encourage walking for healthier life prospects of children and families. Higher levels of airborne pollen coincide with the beginning and end of the school day (16).
- Some patients are unable to manage their allergy – but perhaps it is impossible to do so if repeatedly exposed to allergenic tree species on the route to school and in the playground?

## Recommendations for the UK

### Findings lead to the following recommendations for the UK to reduce exposure to allergenic birch pollen and associated symptoms and sensitisation among atopic individuals:

- Evidence-based, allergy-specific research and guidance to inform urban planning and green infrastructure development
- Clinicians to influence policy makers, regarding effects of climate, air quality and tree species selection on allergy and asthma
- Prioritise low pollen planting where children are at greatest risk of exposure, e.g. highways, school playgrounds, public parks environments accessed by children

- Stop planting birch
- Increase diversity of tree species to avoid excessive quantities of a specific pollen type at any one time, and to promote biodiversity
- Inter-professional MDT research and collaboration: include allergy, botany and horticulture specialists.

CONCLUSIONS

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