Insights into Exercise and Asthma in Children: 35 Years of Research

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“It is our belief that an exercise prescription should be part of the treatment for all cases of asthma. The real question is whether prolonged physical activity and, in particular, outdoor play of children plays a role in prophylaxis against persistent wheezing. If so, the decrease in physical activity might have played a major role in recent increases in asthma prevalence and severity.”

Lucas and Platts-Mills. JACI. 115: 928-934, 2005
Physical Activity: A Double-edged Sword for The Child with Asthma.

• *On the one hand*, exercise is a common trigger of wheezing, occurring in as many as 80% of affected children.

• *On the other hand*, exercise and fitness training seem to benefit asthma control in many children.

So We Are on The Same Page!

**ASTHMA**: A chronic lung disease characterized by inflammation which destroys lung tissue and by contraction of the smooth muscles cells lining the bronchi, making it difficult to breathe. Asthma can be either allergic or non-allergic.
So We Are on The Same Page!

**EXERCISE INDUCED BRONCHO-CONSTRICITION (EIB):** A condition in which vigorous exercise physical activity triggers acute airway narrowing typically (but not exclusively) in people with heightened airway reactivity.

So We Are on The Same Page!

**AIRWAY HYPER-RESPONSIVENESS (AHR):** Exaggerated airway-narrowing response to many environmental triggers, such as allergen and exercise, which is characteristic of asthma.
Impact: Critical Exercise-asthma Treatment Issues Remain Enigmatic And Poorly Studied

• Rare but tragic instances of death due to EIB in asthmatic youth (“Dangerous Exercise,” anaphylaxis)

• Lack of clinically validated paradigms of “return to play”

• Physical fitness and PA are impaired

EIB Is Diagnosed Primarily by Medical History

After cessation of 6-10 min of aerobic exercise...

• cough
• wheezing
• dyspnea
• chest pain
• chest tightness
• cannot keep pace with their peers
• "I just couldn't do it anymore"

In Conclusion...

During the past few years, definite progress has been made in understanding EIA, but the round-about way in which this progress has been made should deter anyone from being too dogmatic or predicting future advances too confidently.

*J P R HARTLEY*

*Llandough Hospital,*

*Penarth, S Glamorgan.*

*Exercise-Induced Asthma (Editorial). Thorax, 1979, 34, 571-574*
In Conclusion...

A true control of the asthma syndrome with its multiple manifestations (exercise-induced, nocturnal, steroid-resistant, etc.), has so far eluded us. The reason is that...the disease... is perhaps much more an integrated system problem than only a bronchial problem.


Mechanisms of EIB—
A Tale of Ideas Come and Gone

*Tried, Tested, and Who Knows*

• Hyperventilation
• Metabolic acidosis
• Vibration
• Airway heat and water loss
• Mediators
Mechanisms: Translational Research Pioneers in Exercise and Asthma

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Mechanisms: Translational Research Pioneers in Exercise and Asthma

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Mechanisms of EIB—Respiratory Heat Exchange

Why does bronchoconstriction develop under these circumstances in asthmatics and not in normal subjects?


Mechanisms of EIB—Respiratory Heat Exchange

These data demonstrate that in the course of conditioning inspired air the intrathoracic and intrapulmonic airways undergo profound thermal changes that extend well into the periphery of the lung. McFadden et al. *J Appl Physiol.* 1985 Feb;58(2):564-70.
**Mechanisms: The Heat-Loss/Humidity Hypothesis for EIB? ...Not Always**

FEV₁ before and at intervals after a six-minute cycling exercise under different respired air conditions: hot, humid air test (1)—control; repeat hot, humid air test (2) after sterilisation of respiratory test system; cold, dry air test.

Ben Dov et al. Thorax 1982;37:630-631

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**Mechanisms: The Still-Cloudy Link Between Exercise and Antigen Triggers**

It is concluded that increased bronchial responsiveness to both exercise and histamine occur after allergen provocation in patients with asthma. (Mussaffi et al. JACI 7:48-52, 1986.)
**Impact: Asthma deaths during sports--Report of a 7-year experience**

Becker et al. JACI, 113: 264-267, 2004

**Impact: Return to Play**

*Return to Play Following Exercise-Induced Bronchoconstriction*

*Thomas W. Allen, DO, FACOI, FCCP*


Conclusions: No agreed-upon protocol for safe return to play following an acute episode of exercise induced bronchoconstriction has been published. A specific detailed protocol for return to play would assist physicians and other health professionals to determine with greater confidence that an athlete is fully recovered and can safely return to play.
**Impact: Effect of Training on Asthma Control**


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**Impact: Public School PE Teachers At the “Frontline” --A Focus Group in SoCal**

• A special education PE teacher had “*never had training in asthma*”

• Doubted current recommendations for “*dealing with asthma attacks in class*”

• Didn’t know “*if inhalers could be used preventively*”
Impact: PA in Children with Asthma

Urban school-aged children with asthma were less active than their peers.

Disease severity and parental beliefs regarding exercise and asthma predicted activity level.

Lang et al. Pediatrics 113:e341, 2004

New Directions: Translational Research Pioneers in Exercise and Asthma

T.A. MacMahon
1943-1999

Thomas A. McMahon
Muscles, Reflexes, and Locomotion
**New Directions: Translational Research Pioneers in Exercise and Asthma**

Remodeling of the airway smooth muscle cell: are we built of glass?

Ren Fabry, Jeffrey J. Fredberg

Harvard School of Public Health, 665 Huntington Avenue, Boston, MA 02115, USA

Accepted 24 January 2003

**New Directions: Novel Approaches to Interaction of Exercise and Asthma**

Might this thermodynamic, structural approach help understand how exercise, thermal and water flux, and obesity impact bronchoconstriction in susceptible individuals?

New Directions: Exercise is Inflammatory

Exercise
- Inflammation
- Leukocytes
- Cytokines
- Adhesion Molecules

Asthma
- Inflammation
- Leukocytes
- Cytokines
- Adhesion Molecules

Why doesn't everyone wheeze with exercise?

New Directions: Where Do We Go From Here?

Image of a baby in a hospital setting.
Dr. George Gregory, one of the pioneering clinician scientists in the battle against Respiratory Distress Syndrome in the 1970s, identified some of the key components that enabled this particular success (NeoReviews 5:e1-5, 2004): "Looking back, one wonders why others did not develop CPAP earlier. All of the clues were there and in hindsight were obvious....What we had in our clinical research unit was an inquisitive environment where everything was questioned and there was no Status Quo."
Physical activity will dramatically improve your outlook today.