

Obesity – effects on asthma and sleep in children



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Plan

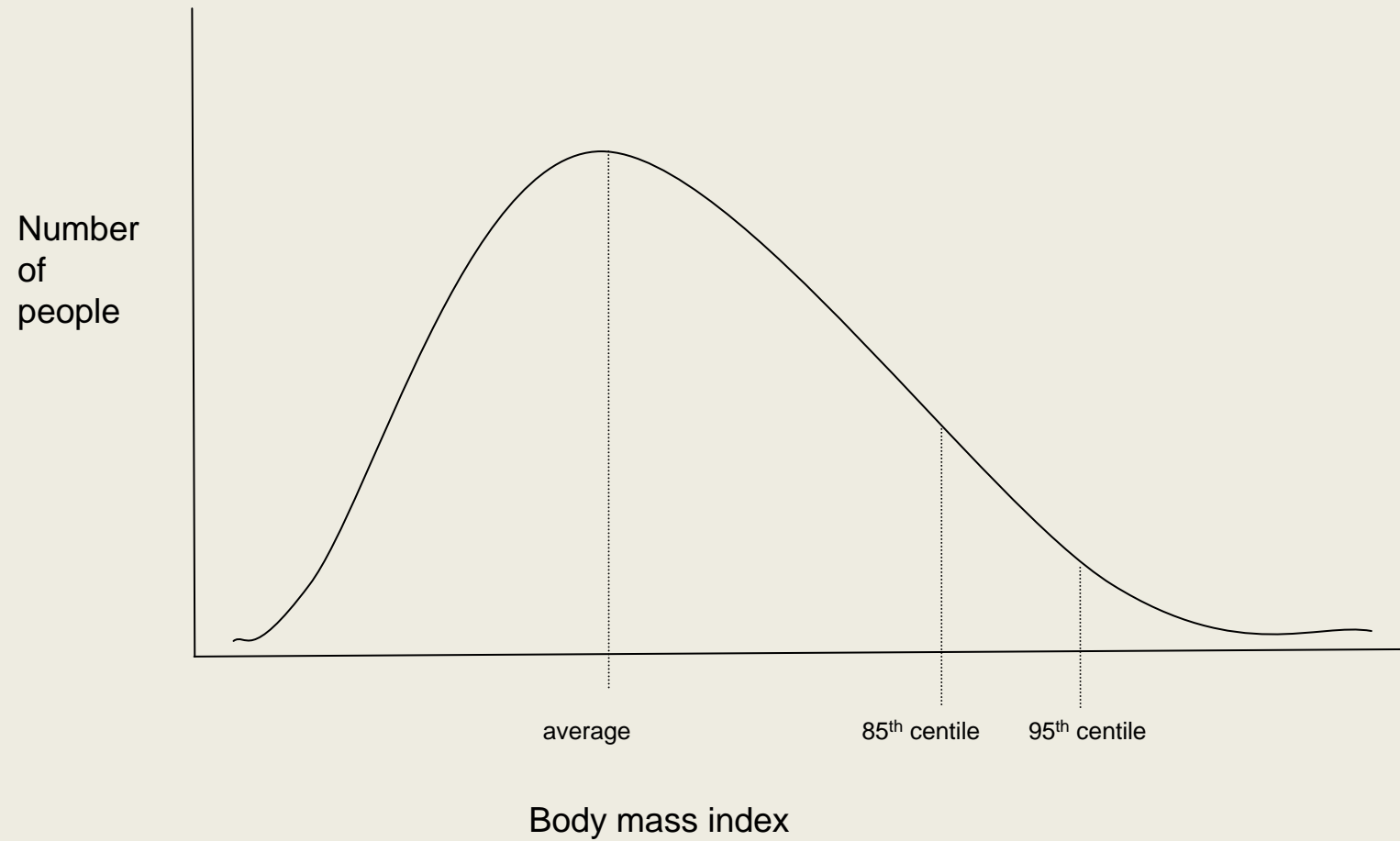
- Some definitions
- Scale of the “obesity epidemic”
- Associations of BMI with asthma and sleep disordered breathing
- Respiratory physiology
- Specific obesity syndromes
- What do we do as respiratory professionals?

Definitions

Body mass index (BMI)

- “normal” – up to 85th centile
- “overweight” – 85th to 95th centile
- “obese” – greater than 95th centile

Population distribution



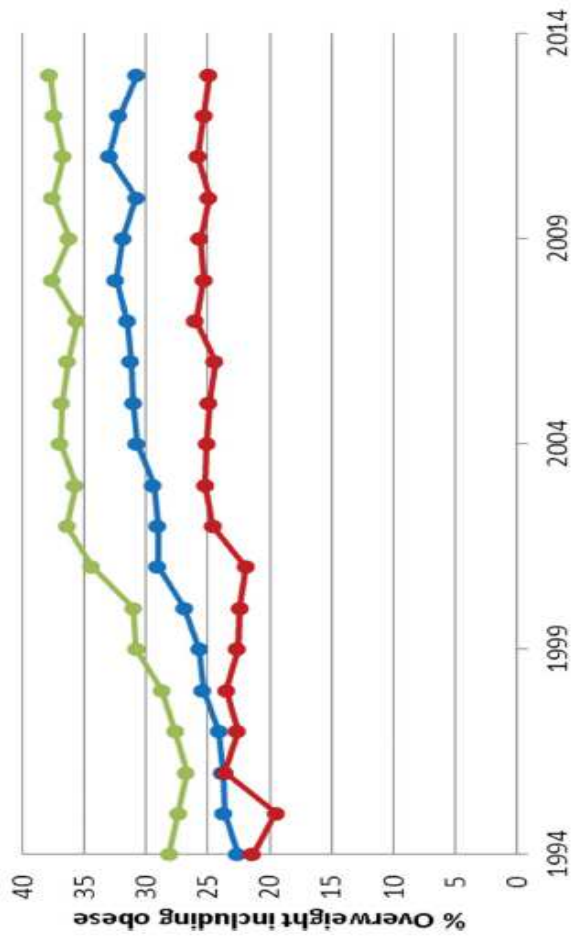
What's the real scale of the problem?

- Jaarsveld et al. *Archives of disease in childhood*. 2015
 - Primary care electronic health records 1994 – 2013
 - 375 practices in England
 - Children aged 2-15 years
 - One or more BMI measurement recorded

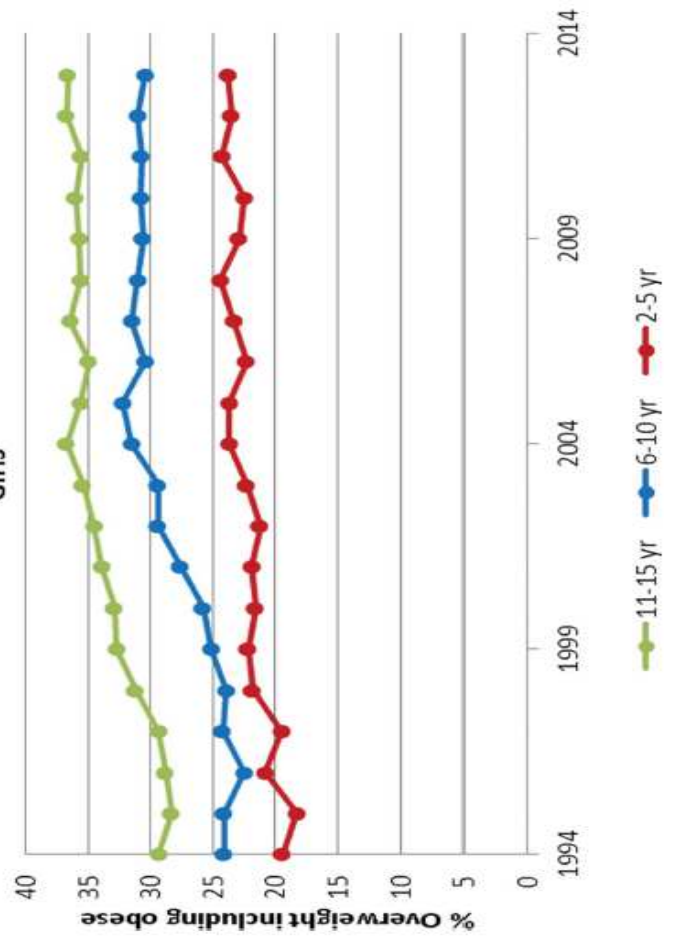
1994-2013

- Data from 370,544 children
- Odds of obesity increased by:
 - **8.1% per year from 1994 – 2003**
 - **0.4% per year from 2004-2013**
- Trends similar in boys and girls
- Continuing increase in older children

Boys



Girls



Summary

- More than a third of children in England are overweight or obese
- Prevalence may have stabilised in recent years
- Increase in adolescent obesity is still evident

This talk in short...

- Is there a link between obesity and asthma?..... **YES**
- Is there a link between obesity and sleep problems?.....**YES**

BMI and asthma

- BMI and asthma have increased in parallel over recent years
- The suggestion is that these conditions are linked
- Obese individuals are at greater risk of:
 - **asthma development,**
 - **have more severe symptoms,**
 - **more treatment resistant,**
 - **poorer QOL**

BMI and asthma

- Children and adolescents
 - Association between BMI and asthma symptoms
 - Sedentary behaviour is associated with increased risk of asthma symptoms
 - BUT symptoms can be reduced with exercise
 - So... does obesity cause asthma?

some paediatric epidemiology

- 2 large population studies
 - ISAAC phase 2 – **10600 8-12yr olds**
 - **16 centres** in affluent countries and 8 in non-affluent
 - Association with BMI and wheeze (symptoms)
 - Association with BMI and airway obstruction (lung function)
 - **NO** association with BMI and atopy (allergy)
 - Stronger relationship in affluent countries

some paediatric epidemiology

- NHANES, USA
- **16,000 2-19yr olds. 1999-2006**
 - Obesity related to current asthma,
 - stronger in non-atopic children
 - Increased CRP in non-atopic asthmatics
- Is obesity asthma a distinct disease?

BMI, asthma and activity

Groth et al J of Asthma 2015

Relationships among obesity, physical activity and sedentary behaviour in young adolescents with and without lifetime asthma

- Hypothesis:
 - Adolescents with asthma would be less physically active
 - Adolescents with asthma would have higher BMI
 - Asthma, BMI and gender would be associated with physical activity levels

- Data from **545** 12-15 year olds from previous birth cohort (USA)
- **11% had diagnosis of asthma**
- **20% were overweight, 26% were obese**
- Only girls with asthma had greater BMI than those without
- Those with asthma were less active than those without
- No difference in BMI between groups.
not that remarkable.....

- Children with asthma are less active
- There is a gender effect

BUT

- It is likely to be asthma, rather than BMI, that contributes to reduced activity as overall there was no difference in BMI

BMI, asthma and vitamin D

- **Vo et al.**

The potential role of vitamin D in the link between obesity and asthma severity/control in children. Expert review of respiratory medicine. 2015

- Vitamin D is low in obese individuals
- Emerging link between steroid responsiveness and vitamin D levels

BMI, asthma and cigarette smoke exposure

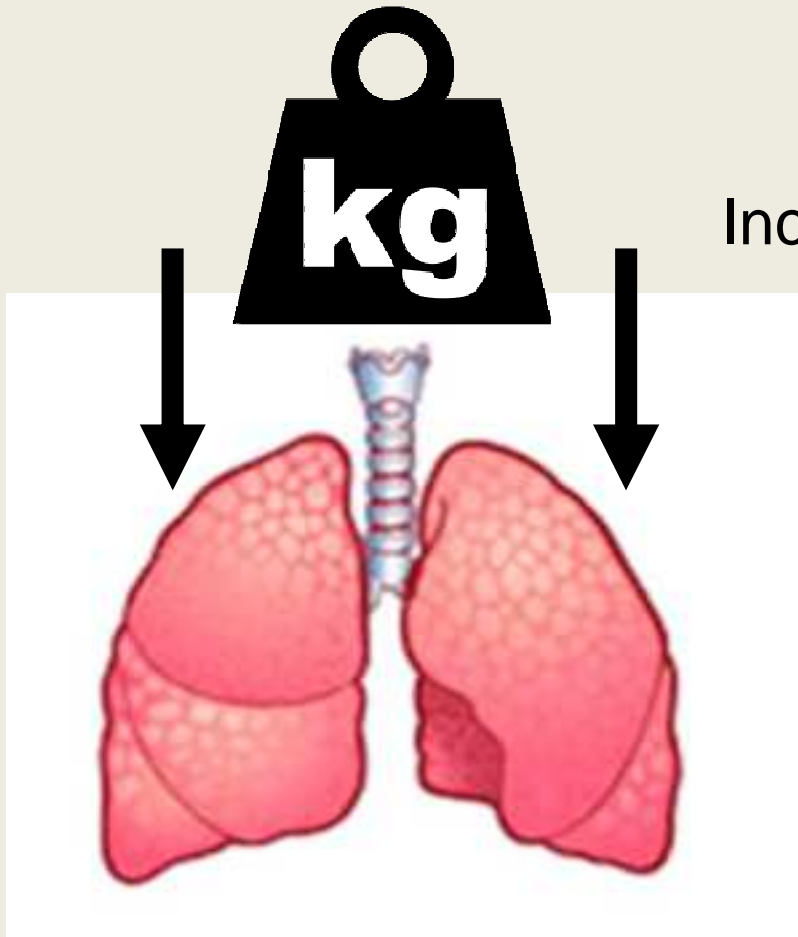
- **Kitsantas et al.**

Association of asthma with obesity among adolescents exposed to environmental tobacco smoke. Journal of Asthma. 2015

- Large survey of US households
- Obese adolescents exposed to ETS more likely to suffer from asthma than non-obese in same household

Effects of obesity on the lungs

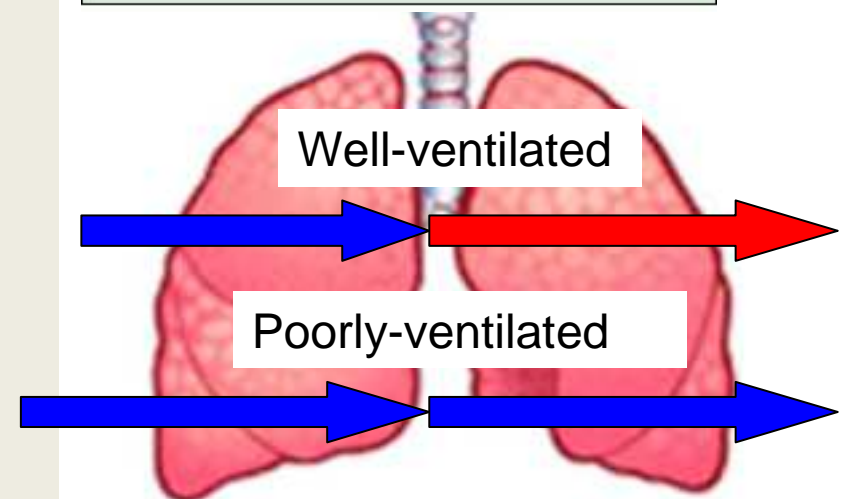
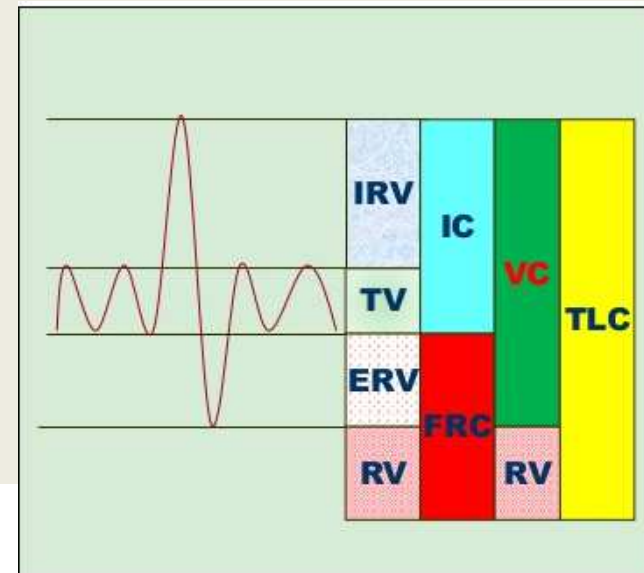
Mechanical effect



Increased adiposity leads to:

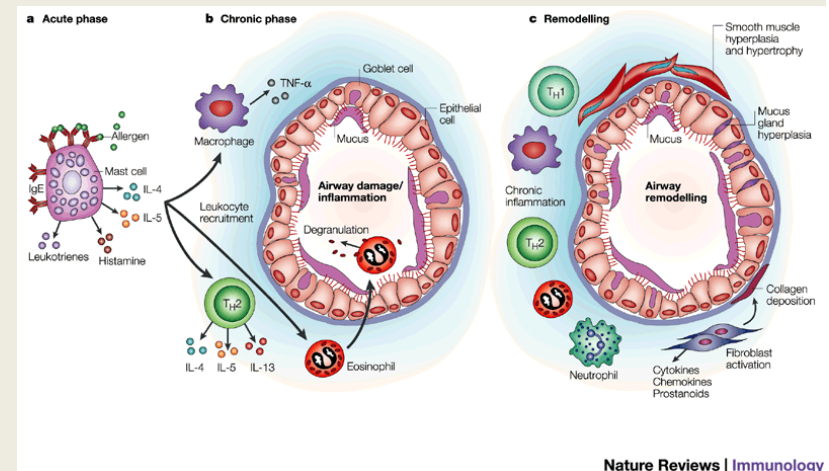
- Reduced lung capacity
- Reduced reserve volume
- Ventilation perfusion mismatch

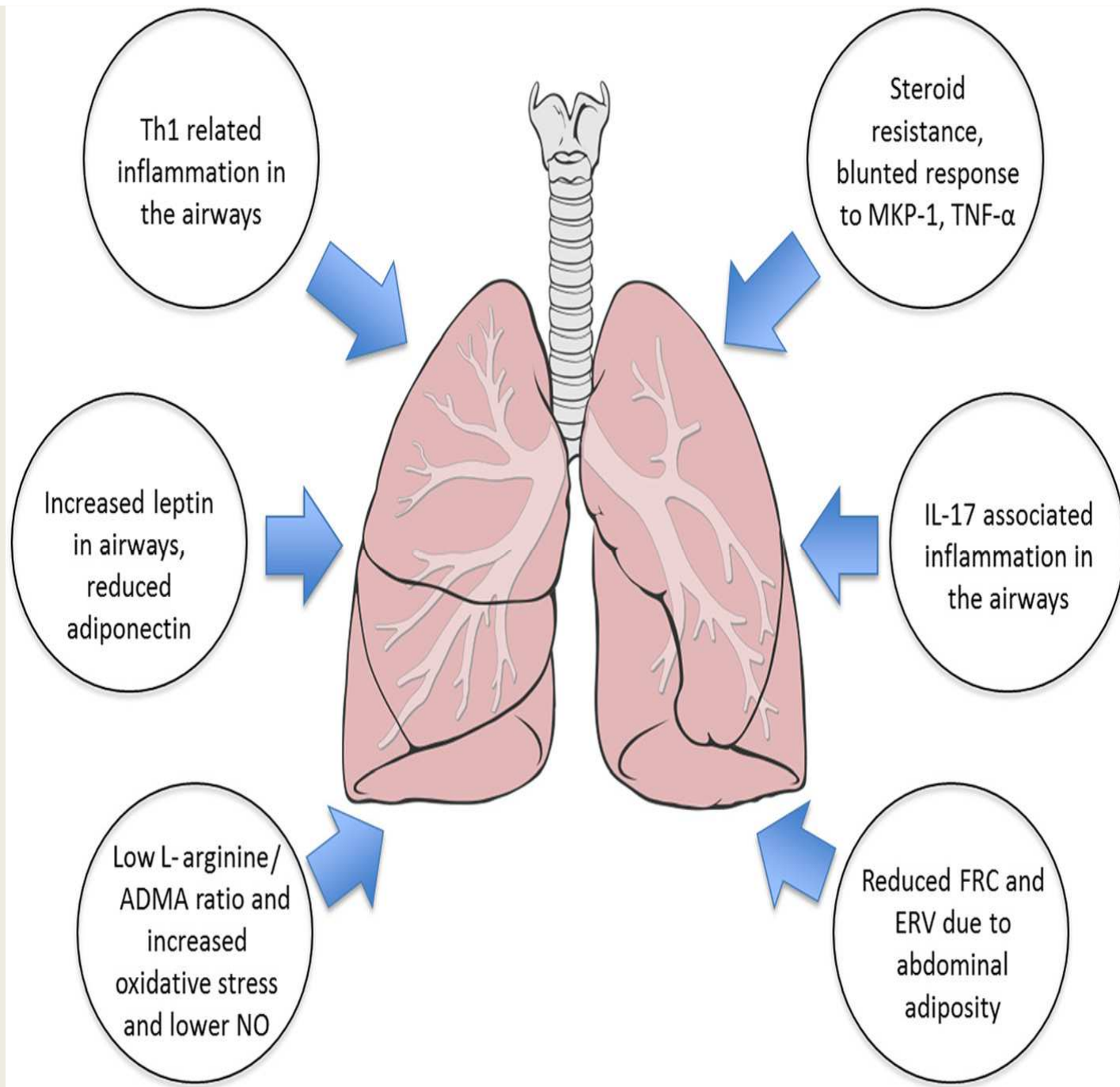
- Functional residual capacity is a reserve volume to efficiently exchange gas
- Ventilation perfusion mismatch means blue blood is pumped round poorly-ventilated lung, decreasing the efficiency of the system



Immune and metabolic effects

- Obesity is known as a chronic systemic inflammatory disorder
 - Decreased eosinophils and increased neutrophils
 - Th1 type response rather than Th2
 - Elevated leptin levels
 - Increased oxidative stress
 - Steroid resistance





Conclusions

- **Increased asthma in obese children**
- BMI is not necessarily causative,
- **BMI is a pro-inflammatory** – therefore a different type of disease
- **Often resistant to conventional treatment** (steroids) - approach might be different in the clinic
- Increased activity and better weight management is highly likely to improve asthma

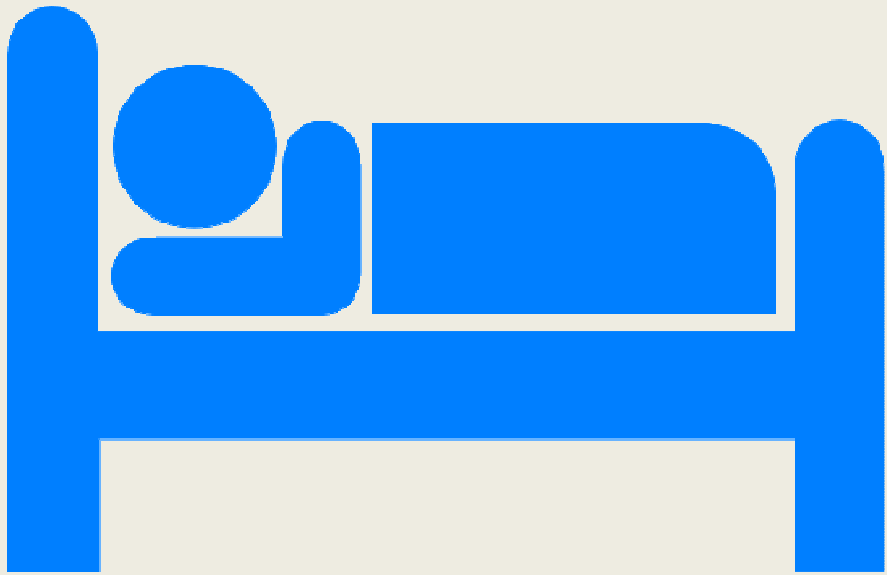
Summary

Obesity + Asthma = increased symptoms

Obesity – ~~asthma~~ = asthma-like symptoms

Asthma → Obesity → Increased symptoms

Obesity and Sleep



BMI and sleep

Obstructive Sleep Apnoea Syndrome (OSAS)

- Is common

- OSAS prevalence may be as high as 5.7% children

- AAP Technical Report, Marcus *et al. Pediatrics* 2012

- Affects learning

- OSAS is associated with cognitive impairment

- Friedman *et al. Sleep* 2003

- O'Brien *et al. Pediatrics* 2004

- Suratt *et al. Pediatrics* 2007

- Cognitive deficit may be as much as 10 IQ points even in mild disease

- Kohler *et al. PLoS* 2009

Obesity and OSAS

- **Study of night time respiratory support**

- OSAS deemed due to obesity in $>2/3$ of children

Marcus et al. Pediatrics 2006

- **Adenotonsillectomy**

- Obese children have less satisfactory results

Clinical Practice Guideline: Marcus et al. Pediatrics 2012

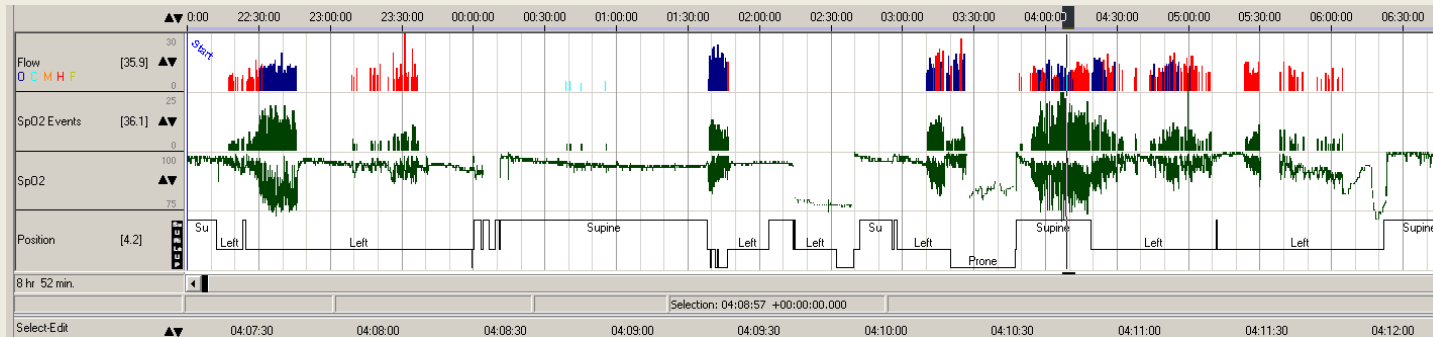
- BMI reported as a demographic factor that influences Apnoea-hypopnoea index (AHI) post-adenotonsillectomy

Bhattacharjee et al. Am J Respir Crit Care Med 2010

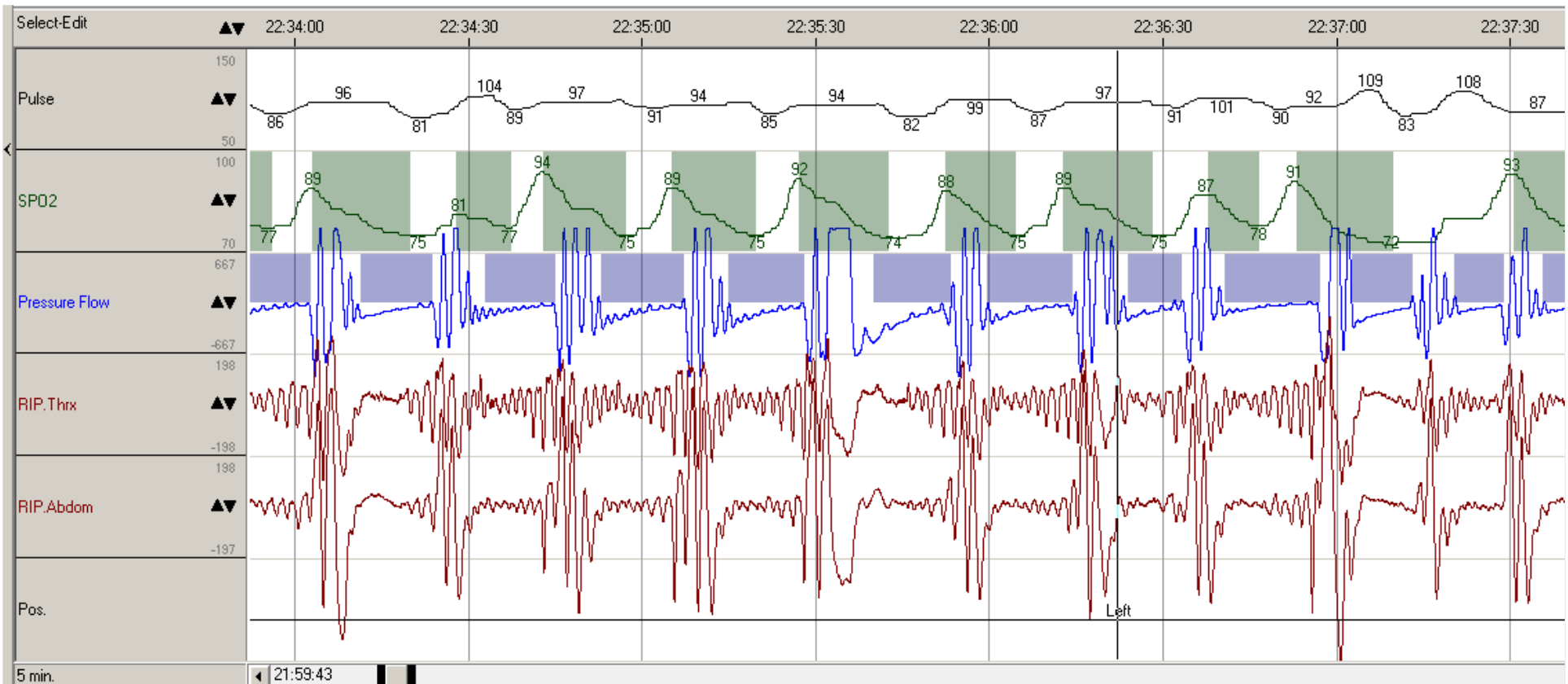
Clinical Case

- 12-year old girl
- Weight 148kg. (>23 *stones*)
- Snores at night
- ECG normal
- No evidence of hypertension or glycaemic dysregulation
- Referred from another centre for:
 - Sleep study
 - +/- institution of respiratory support

Sleep study



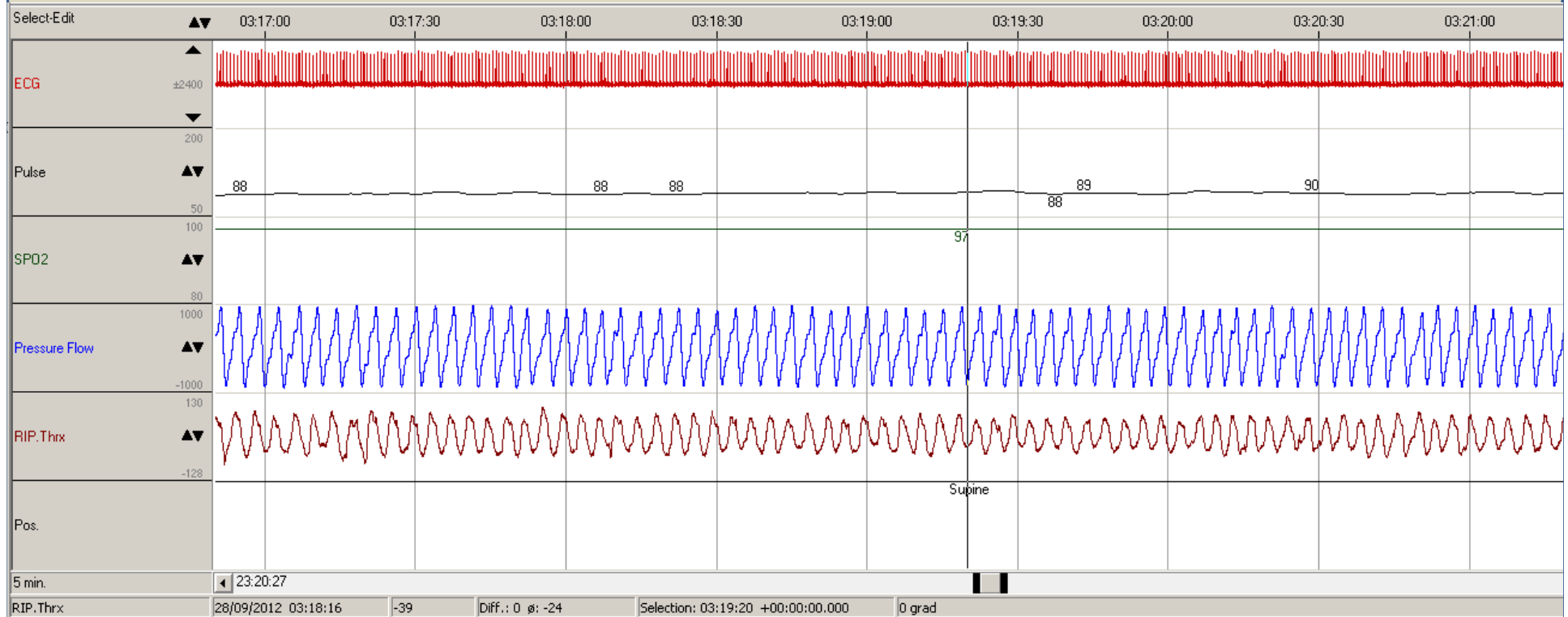
- Hypnogram:
- Multiple sleep stage related desaturations
- AHI = 23/hour (very high!)
- Lowest SpO₂ = 69% (very low!)
- NB: tcCO₂ stable throughout
- - no evidence of obesity hypoventilation



Screenshot (5 minute window):

- Frequent obstructive apnoeas seen
 - Loss of airflow
 - Effort preserved
- Associated dips in SpO₂ to 72%

Started on CPAP – secondary prevention



OSAS

Primary prevention in the obese population?

American Academy
of Pediatrics



DEDICATED TO THE HEALTH OF ALL CHILDREN™

Organizational Principles to Guide and Define the Child
Health Care System and/or Improve the Health of all Children

CLINICAL PRACTICE GUIDELINE

Diagnosis and Management of Childhood Obstructive Sleep Apnea Syndrome

- “Clinicians should recommend weight loss in addition to other therapy if a child/adolescent with OSAS is overweight or obese.”
 - **Evidence Quality: Grade C**
 - **Recommendation Strength: Recommendation**

Marcus *et al.* Pediatrics 2012

Specific Obesity Syndromes

Prader-Willi syndrome

- Chromosome 15 deletion (from father) or maternal uniparental disomy
- Causes neonatal hypotonia initially
- Develops into behavioural problems, obesity due to hyperphagia, mental retardation, short stature, scoliosis
- Abnormal ventilatory response to hypoxaemia
- May not arouse properly during obstructive sleep episodes

Down Syndrome

- Trisomy 21
- Typical facial features including small mouth and relative macroglossia
- High risk of OSAS

Down syndrome and OSAS

- Prevalence of OSAS is much higher in children with DS
 - Figures as high as 79% reported
Dyken et al. Arch Pediatr Adolesc Med 2003
- Success rates with adenotonsillectomy are lower in DS
Marcus et al. Paediatrics 2012
 - Ongoing airway hypotonia after adenotonsillectomy
Merrell et al. Int J Pediatr Otorhinolaryngol 2007
- CPAP recommended as second line treatment for children with DS and OSAS

Prevention of obesity-related disease

- **Primary prevention deals with weight directly**
 - i.e. we should be recommending weight reduction to our patients
- Secondary prevention deals with the consequences of obesity (e.g. CPAP)

How do we tackle the problem?

Example from NHS Lothian

NHS
Lothian



*Worried about your child's weight?
Want to help them lead a healthy and active life?*

- Paediatric weight management dietetics

Plus

- Get Going family-focused weight management community programme

Get Going

- Dietetic service for all initial referrals
- Further referral to community programme:
 - Children aged 5-17
 - BMI >91st centile
 - Involves whole family
 - 9 sessions over 9 weeks
 - Followed by maintenance programme

Aims of Get Going

- Promoting weight maintenance and general dietary improvements
- Not promoting weight loss
- Emphasis on improvements to whole family's lifestyle
- 1200+ children referred over past 4 years

Evidence of success?

- 2014/15 – Get Going community programme
- **168 referrals**
- **131 progressed to community programme**
- **102 completed 75% of sessions**

- Referrals made from various professionals
- No hard evidence of BMI reduction in children, however parental BMI has been noticed to improved

INSIDE

LET'S LEARN!
See our four-page guide to vocational and adult education classes in East Lothian



East Lothian

Living

www.eastlothian.gov.uk

SUMMER 2015 - NEWS FROM YOUR COUNCIL

PAGE 6

We're on track
Update on the council's performance

www.nhslothian.scot.nhs.uk/getgoing

Families Get Going together

LOCAL families can enjoy lifestyle tips and support, thanks to the Get Going programme, a joint East Lothian Council and NHS Lothian initiative.

Get Going is a free, fun family healthy lifestyle programme which helps children work towards a healthy weight.

The Lawson family from Wallyford have enjoyed taking part. Mum Jacqueline explained it's about making small lifestyle changes as a family. She said: "My husband Davie and I both realised that we had health problems associated with being overweight and we didn't want our son Jamie to experience similar problems."

Supported by Healthy Lifestyle Co-ordinator Chuxx Onyia, the Lawsons learned more about eating well and being more active. Jamie, who is in primary three, took part in fun activities and games and also enjoyed special 'taster' sessions of healthy foods.

"The programme starts with an initial one-to-one consultation with the family," explained Chuxx. "This is followed by interactive group sessions, delivered by qualified coaches, covering healthy eating, physical activity and making positive lifestyle choices."

"The children can make friends and take part in fun, active games while parents and carers share ideas and experiences."

On completion, families can join the maintenance programme, Keep Going.

The Lawsons have no hesitation in recommending the programme to other East Lothian families.

Jacqueline said: "A year ago, I was having to walk with the support of two crutches. Following medical help and support, I have now lost nine stone and am continuing to follow a healthier lifestyle, which includes being able to play with Jamie."

"Davie has taken up Munro bagging. He has climbed Ben Nevis twice and shed five stone since adopting a healthier lifestyle. As a family, we enjoy bike rides and long walks and are all much more aware of the right types of food to eat and being more active."



Jamie Lawson and his family enjoyed the programme

FOR INFORMATION,
visit www.nhslothian.scot.nhs.uk/getgoing to find out more about the Get Going programme or contact Chuxx on onyia@eastlothian.gov.uk or 01620 828760.

Conclusions

- Obesity is a major threat to children's and adults' health
- Full consequences are still to be seen (diabetes, heart disease etc. etc.)
- Asthma and sleep are among the most important associated conditions in children
- Impact of obesity should be communicated to families in our clinics
- Family and community programmes are likely to be a way forward

Thankyou

