Abstract P86 Table 1 *In vitro* medication delivery through the test VHC with small/medium face masks at different flow rates and holding times

Flow rate and corresponding age	Mask	Holding time, s	Mean medication delivery through test VHC, µg/dose	Body weight 50th percentile, kg	Medication delivered per dose, ng/kg*
4.9 L/min	Small	0	0.85 (±0.04)	7.5–9.9	86–113
(6–12 months)		2	0.86 (±0.14)		87–115
		5	0.55 (±0.16)		56–73
		10	0.62 (±0.02)		63–83
8.0 L/min	Medium	0	0.74 (±0.05)	12.3–18.0	41–60
(2–5 years)		2	0.93 (±0.05)		52–76
		5	0.72 (±0.07)		40–59
		10	0.57 (±0.05)		32–46
12.0 L/min	Medium	0	1.16 (±0.07)	18.0	64
(>5 years)		2	0.96 (±0)		53
		5	0.78 (±0.18)		43
		10	0.61 (±0.02)		34

Data corresponding to age group 13–23 months are not available.
* Inhalation of 2.5 µg tiotropium Respimat (as two actuations) in a 70 kg adult without use of the test VHC and face mask delivers approximately 2.5 µg or 36 ng/kg.

P87 BENCHMARKING OF PAEDIATRIC DIFFICULT ASTHMA PHYSIOTHERAPY SERVICES

C Wells, N Collins, A Bush, L Flemming, S Saglani. *Department of Respiratory Paediatrics The Royal Brompton Hospital, London, UK*

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Introduction Children with difficult asthma (DA) comprise 2%–5% of all children with asthma but use 50% of national asthma health care provisions, they have high levels of morbidity and poor quality of life. Guidelines recommend children with DA should be assessed by a specialist multidisciplinary team, including physiotherapy, to confirm an asthma diagnosis, exclude alternative causes of persistent symptoms, manage co-morbidities, confirm adherence and ensure treatment is appropriate. Physiotherapy may involve breathing pattern retraining, airway clearance, exercise, symptom differentiation, relaxation techniques, self-management and overcoming barriers to adherence. Currently there are no validated condition specific screening tools, outcome measures, methods of assessment or standardised treatments for breathing pattern disorders in children. Physiotherapy intervention improves asthma symptom scores, quality of life[1] and A and E attendances and hospital admissions.[2] We aimed to investigate physiotherapy services and treatments currently being offered at paediatric centres nationally and whether the current guideline recommendations were being met.

Method Physiotherapists from twenty-two UK hospitals were invited to complete a questionnaire about service size and provision, referral systems, screening tools, assessment and outcome methods and treatments offered.

Results 18/22 centres responded. Sixteen (89%) did not have funded DA physiotherapy, twelve (66%) had no dedicated DA physiotherapy time. Seventeen (94%) relied on referrals from DA consultants and nurses, rather than physiotherapists having the opportunity to routinely assess DA patients. There was no consensus about paediatric screening tools, assessment protocols or outcome measures (figure 1). There was marked variation in what was offered ranging from only performing airway clearance reviews to a full breathing pattern assessment, cough management, sleep, continence, exercise prescription, musculo-skeletal treatment, relaxation/anxiety management, sinus management and advice and education.

Conclusion Paediatric physiotherapy services for DA are largely *ad hoc* and reactive. Despite guideline recommendations, physiotherapy for paediatric DA is currently an unmet clinical need with no agreed diagnostic or management algorithms. There is a clear need to better define the role of physiotherapy in DA.

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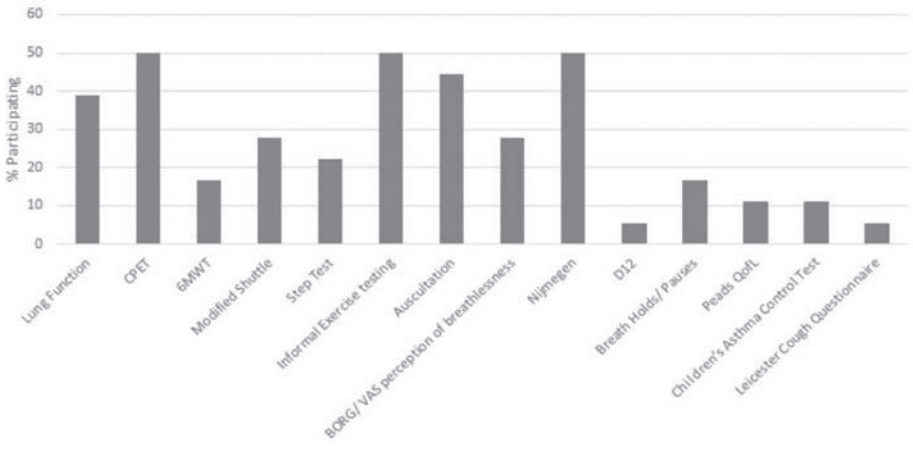

Abstract P87 Figure 1 Outcome measures used by physiotherapists across the UK.

P88 RELATIONSHIP BETWEEN EXHALED NITRIC OXIDE AND LUNG CLEARANCE INDEX IN PRE-SCHOOL CHILDREN WITH A RANGE OF RESPIRATORY SYMPTOMS

[1]Y Bingham, [2]N Sanghani, [2]S Irving, [1]A Bush, [1]L Fleming, [1]S Saglani. [1]*Imperial College London, London, UK*; [2]*Royal Brompton and Harefield NHS Foundation Trust, London, UK*

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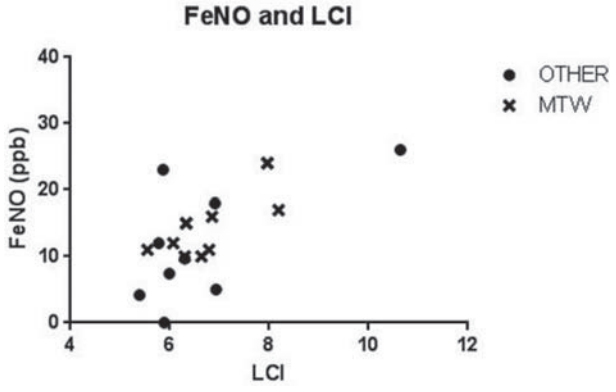
Introduction Both exhaled nitric oxide (FeNO), a non-invasive marker of eosinophilic airway inflammation, and lung clearance index (LCI), an effort independent assessment of distal airway function, are increased in pre-school children with multiple trigger wheezing (Sonnappa JACI 2010;126:519–26). However, whether there is any relationship between the two measures is unknown. We hypothesised that FeNO and LCI are positively related in pre-school children with a range of respiratory symptoms and this relationship would be strongest in pre-school wheeze.

Methods Patients aged between 2 and 6 years were recruited from the paediatric respiratory department at our tertiary centre. FeNO was measured using the offline technique (Niox Mino, Aerocrine AB, Sweden) and LCI was measured using the multiple breath washout technique (Sulphur hexafluoride tracer gas, photoacoustic gas analyser (Innocor, Innovision, Denmark)).

Results 19 children (median age 4.2, range 2.7–5.8 years) had assessments of both FeNO and LCI on the same day. Respiratory diagnoses were: multiple trigger wheeze (MTW) n=10, episodic viral wheeze (EVW) n=5, cough n=1, recurrent infections n=1, obliterative bronchiolitis (OB) n=1, sleep disordered breathing n=1. A significant correlation was found between FeNO and LCI, in pre-school children with respiratory symptoms (Spearman correlation coefficient r=0.5, p=0.02) (figure 1). When the MTW and EVW groups were compared, there was no correlation between FeNO and LCI in EVW, but there was a significant relationship in MTW (r=0.6, p=0.05).

Conclusions There was a positive relationship between FeNO and LCI in pre-school children with a range of respiratory symptoms. The relationship was strongest in those with recurrent multiple trigger wheeze. These data provide further evidence for different pathophysiologies in MTW and EVW, implying the need for different treatment approaches.



Abstract P88 Figure 1 Relationship between offline exhaled nitric oxide (FeNO) and lung clearance index (LCI). MTW: multiple trigger wheeze.

P89 VENTILATION HETEROGENEITY IS A FEATURE OF CHILDREN WITH SEVERE ASTHMA AND NORMAL SPIROMETRY

[1]A Nuttall, [2]C Beardsmore, [3]E Gaillard. [1]*Department of Infection, Immunity and Inflammation, College of Medicine, Biological Sciences and Psychology, University of Leicester, Leicester, UK*; [2]*Department of Infection, Immunity and Inflammation, College of Medicine, Biological Sciences and Psychology, Leicester Institute for Lung Health, NIHR Leicester Respiratory Biomedical Research Unit, University of Leicester, Leicester, UK*; [3]*Department of Infection, Immunity and Inflammation, College of Medicine, Biological Sciences and Psychology, Leicester Institute for Lung Health, NIHR Leicester Respiratory Biomedical Research Unit, University of Leicester and University Hospitals of Leicester NHS Trust, Leicester, UK*

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Introduction Ventilation heterogeneity (VH) is a feature of a subgroup of adults with asthma (Verbanck et al. AJRCCM 1999; 159.5:1545–1550), however less is known regarding VH in childhood asthma. Previous data indicates VH is raised in asthmatic children compared with controls, and may be particularly high in those with severe or poorly controlled asthma. This may be important as many children report poor symptom control, despite normal spirometry.

Objectives We aimed to study the relationship between ventilation heterogeneity, disease severity, and symptom control in children with asthma.

Methods Stable asthmatic children were recruited from the Difficult Asthma Clinic, with controls recruited from diabetes clinic patients and their siblings. Asthma severity was classified in accordance with GINA guidelines (Step 1–3=Mild Moderate, Step 4–5=Severe). Asthmatics completed C-ACT/ACT to assess symptom control (score ≤19 = uncontrolled). All children performed Spirometry. Ventilation heterogeneity was assessed using Multiple-Breath Nitrogen Washout (MBNW) (Exhalyzer-D, Ecomedics). MBNW was performed in triplicate, with Lung Clearance Index (LCI) and indices of ventilatory heterogeneity in conductive and acinar airways (S_{cond} and S_{acin}, respectively) calculated.

Abstract P89 Table 1 MBNW results, displayed as median (range). Comparisons made using mann-whitney test, *p<0.05=significant

	Controls n=7	Mild-Moderate Asthma n=7	Severe Asthma n=21	*Mild-Moderate vs Severe Asthma*
LCI	6.48 (5.78–7.03)	6.69 (5.63–7.40)	7.50 (5.79–9.79)	p=*0.023**
S_{cond}	0.014 (0.008–0.022)	0.016 (0.007–0.051)	0.026 (0.009–0.079)	p=*0.186*
S_{acin}	0.055 (0.035–0.077)	0.054 (0.043–0.158)	0.082 (0.044–0.151)	p=*0.291*

Results 35 participants aged 7–16 completed testing (7 controls, 7 mild-moderate asthma, 21 severe asthma). Results for MBNW displayed in Table 1. All MBNW parameters were normal in control subjects. Only the severe asthmatics had MBNW Results significantly higher than controls (LCI **p=*0.006***, S_{cond} **p=*0.021***, S_{acin} **p=*0.040***). LCI was raised in 1/7 mild-moderate and 13/21 severe asthmatics. S_{cond} was raised in 2/7 mild-moderate and 11/21 severe asthmatics. S_{acin} was raised in 1/7 mild-moderate and 4/21 severe asthmatics. 18/28 asthmatics had uncontrolled symptoms as assessed by the C-