(14.8y [12.5y-16.7y]). LCI was significantly higher in those with CF when using both devices (mean difference[95% CI], CF-controls): 2.47[1.4;3.5] for the MS-SF_6 and 2.20[1.2–3.2] for N_2-MBW.

There were no significant group differences between devices for either LCI (mean difference[95% CI]) -0.14[-0.45;0.16] or FRC -0.15L[-0.2;-0.08]. Within-subject variability was proportional to mean values (see Figure) and ranged from 0.4–15.7% for LCI and 0.0–19.6% for FRC.

Conclusion Despite some previous reports that N_2-washout results in higher LCI values than MS-SF_6 washout, on average, we found similar values in both healthy school-age children and those with CF. Further work is required to examine causes of within-subject variability and assess validity and sensitivity over a wider age range, including preschool children, before commercial N_2-MBW devices can be confidently used in multi-centre trials.

REFERENCE

1 Aurora *et al*. *Am J Respir Crit Care Med.* 2011;183:752–8

P100 THE FEASIBILITY OF USING COMMERCIAL MULTIPLE BREATH NITROGEN WASHOUT DEVICES IN SCHOOL-AGED CHILDREN

[1]E Raywood, [1]J Duncan, [1]S Legg, [2]P Aurora, [1]J Stocks. *[1]Instititue of Child Health, Univeristy College London, London, UK; [2]Great Ormond Street Hospital and NHS Foundation Trust, London, UK*

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Background Multiple breath inert-gas washout (MBW) using sulphur hexafluoride (SF_6) measured by mass spectrometry (MS), is sensitive to early lung disease in children with Cystic Fibrosis (CF)[1] but is not widely available. To increase the accessibility of MBW, commercial devices have been adapted using nitrogen-washout (N_2-MBW). Our aim was to assess the feasibility of two commercial N_2-MBW devices as supplied by the manufacturers compared to a custom-built MS system in school-aged children.

Methods Patients with CF and controls performed MBW on three devices; the Exhalyzer®D (ECO MEDICS AG); the EasyOne Pro®LAB (ndd Medizintechnik AG) and the MS system (AMIS 2000, Innovision ApS) on the same test occasion (order randomised). Attempts were made to obtain 3 technically acceptable runs/device (maximum 8 attempts on each).

During testing children watched a DVD and were encouraged to breathe normally. Data were analysed using the 'clinical application' setting for both commercial devices, and customised software for the MS. Quality control was in accordance with the ATS/ERS consensus statement[1] and manufacturers' guidelines.

Results 14 control (mean[range]age: 15.0[12.5–16.7]yrs) and 18 children with CF (13.5[7.8–17.4]yrs) were assessed. The median (range) number of runs attempted were: MS 3(3–8), Exhalyzer®D 4(3–6), EasyOne Pro®LAB 4(3–8). Average calibration time was shorter for EasyOne Pro®LAB (5 min) than either MS (11 mins) or Exhalyzer®D (12 min). Total test duration was similar between devices and dependent on disease severity.

3 acceptable MBW runs were achieved in all children using the MS, 75% with the EasyOne Pro®LAB, and 47% on the Exhalyzer®D system (see Table). Reasons for failure with Exhalyzer®D were usually due to technical/equipment problems, whereas for the EasyOne Pro®LAB these were generally associated with marked changes of breathing pattern at commencement of washout, leading to exclusion of one or more runs.

Discussion Despite use in an experienced MBW centre, our initial attempts to implement commercial MBW devices according to manufacturers' guidelines resulted in a relatively low success rate in schoolchildren when compared to MS. Subsequent feedback to manufacturers has led to further adaptations which should improve feasibility in future, although this has yet to be assessed in very young children.

Abstract P100 Table 1 Number (n) of technically satisfactory runs according to MBW device

	MS	EasyOne Pro Lab	Exhalyzer D
n = 3	32	24	15
n = 2	0	7	1
n = 1	0	0	1
None acceptable	0	1	15

REFERENCE

1 Robinson *et al*. *Eur Resp J* 2013

P101 EFFECTS OF USING A MASK VS. MOUTHPIECE ON THE MULTIPLE BREATH INERT GAS WASHOUT TECHNIQUE

[1]S Lum, [1]J Stocks, [2]W Kozlowska, [3]P Aurora. *[1]UCL, Institute of Chi Ld Health, London, UK; [2]Kings College Hospital NHS Foundation Trust, London, UK; [3]Great Ormond Street Hospital for Children NHS Foundation Trust, London, UK*

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Assessment of ventilation inhomogeneity using the multiple breath washout (MBW) technique has been shown to be more sensitive than spirometry in detecting early cystic fibrosis lung disease throughout childhood. The current "gold standard" interface for school age children and adults is a mouthpiece. Although masks are better tolerated by infants and younger children, their use increases equipment deadspace-which could influence measured values and hence interpretation of results. The aim of this study was to examine the effect of using a mask vs mouthpiece on values of functional residual capacity (FRC) and the lung clearance index (LCI) derived from MBW.

Method Comparisons were performed in healthy adults. The study design incorporated repeated measures as well as interface comparison. The mask was selected to mimic measurement conditions in infants, the deadspace of 85 mL being approximately 1–2 ml/kg in adults. Mouthpiece (MP) deadspace was ~5 ml. Subjects were randomly allocated to group A (Mask-Mouthpiece-Mouthpiece) or group B (Mouthpiece-Mouthpiece-Mask) protocols. Each subject performed a total of 9 MBW runs, in 3 sets, each consisting of 3 runs, with a 5-minute break between each set. MBW was performed using a mass spectrometer as described previously (Aurora 2005 AJRCCM). Paired t-tests with 95% limits of agreement were used to establish repeatability (MP1 vs. MP2) and any differences between Mask vs. Mouthpiece. This study was approved by the local research ethics committee and written consent obtained from subjects.

Results Technically satisfactory comparative data were obtained on 15 occasions in 14 adults (36% males; age: 22–56 years). Respiratory rate and tidal volume were similar using either approach. Repeatability: Both FRC and LCI were repeatable using the mouthpiece [(Mean (95% CI) diff: FRC: 0.012L (-0.05;0.07); LCI: -0.1(-0.3; 0.1)]; Figure 1A and B. Mask vs. Mouthpiece: FRC and LCI were both significantly higher when assessments were made using a mask compared with a mouthpiece: FRC: 0.101L (0; 0.202); LCI: 0.4 (0.2;0.7); Figure 1C and D.

Conclusion The increase in LCI when using a facemask exceeded normal within test variability in adults and could

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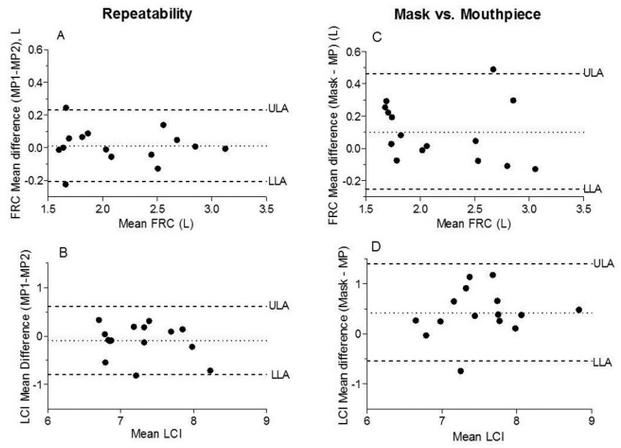

Abstract P101 Figure 1 A-D: Bland and Altman graphs for FRC and LCI showing within-test repeatability using the mouthpiece (Figure 1A and B) and comparison between Mask vs. Mouthpiece (Figure 1C and D). Dotted line denotes the mean difference and the dashed lines either side denote the upper and lower limits of agreement (ULA, LLA)

influence interpretation of results especially if different patient interfaces are used when collecting data in younger children.

P102 RECOVERY OF BASELINE LUNG FUNCTION AFTER A PULMONARY EXACERBATION IN CHILDREN WITH PRIMARY CILIARY DYSKINESIA (PCD)

M Sunther, S Carr, C Hogg, A Bush. *Royal Brompton Hospital, London, UK*

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Rationale Spirometry in children with cystic fibrosis (CF) frequently fails to return to baseline after treatment for a pulmonary exacerbation [Am J Respir Crit Care Med 2010; 182: 627–32]. It is unclear however how often lung function returns to previous baseline levels after treatment of a pulmonary exacerbation with intravenous antibiotics in children with PCD.
Objectives To determine in children with PCD: (1) the proportion treated for a pulmonary exacerbation who recover to baseline FEV_1 within 3 months and at 12 months and (2) to try to identify factors which are associated with failure to recover spirometry.
Methods Cohort study using the PCD database for children at the Royal Brompton Hospital from 2003 to 2013. We selected the first clinically diagnosed pulmonary exacerbation treated with intravenous antibiotics. The best FEV_1 in the 3 months after treatment and at 12 months was compared to the best FEV_1 in the 12 months before treatment (baseline). Recovery to baseline was defined as any FEV_1 after treatment that was greater than or equal to 90% of the baseline FEV_1.
Results Of the 30 children treated for pulmonary exacerbations, 77% recovered to baseline lung function within 3 months and 73% at 12 months. There were no significant differences between the responders and non-responders in terms of age, sex, ethnicity, BMI, baseline FEV_1, persistent sputum infection or use of antibiotic prophylaxis or mucolytic agent (Table).
Conclusions Similar to findings in CF, around 25% PCD patients fail to recover to baseline lung function after treatment of a pulmonary exacerbation with intravenous antibiotics. Better treatment strategies are needed, and the results also suggest that prevention of exacerbations would be a useful end-point in clinical trials.

Abstract P102 Table 1 Characteristics of patient cohort

Characteristic	Responder (n=23) N (%)	Non responder (n=7) N (%)
Median age, yr	11.4	12.2
Median BMI, kg/m^2	17.7	16.8
Female sex	14 (60)	4 (57)
Caucasian	12 (52)	4 (57)
FEV_1 < 40%	2 (9)	0
Persistent infection		
Haemophilus influenzae	5 (22)	1 (14)
Staphylococcus aureus	1 (4)	1 (14)
Streptococcus pneumoniae	2 (9)	0
Pseudomonas aeruginosa	0	2 (9)
Prophylactic antibiotic	17 (74)	6 (86)
Mucolytic agent	7 (30)	1 (14)

P103 DO CHILDREN WITH PRIMARY CILIARY DYSKINESIA HARBOUR THE SAME PATHOGENS IN THE UPPER AND LOWER AIRWAY?

GS Marsh, NL Collins, A Bush, C Hogg, SB Carr. *Royal Brompton Hospital, London, UK*

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Background Primary ciliary dyskinesia (PCD) is characterised by chronic nasal discharge and lower respiratory tract infections. We aimed to assess the prevalence and concordance of pathogens present in samples from the upper (UA) and lower airway (LA) of children with PCD.
Method Microbiology samples from UA (naso-sinal lavage or nasal swab) and LA (sputum or cough swabs) were taken at the same time from children attending a specialist PCD centre, diagnosed on standard criteria (Eur Respir J 2009:34:1264–1276).
Results 70 children (30 male), median age 10.7 yrs (range 1–18), were studied. 36/70 were prescribed long term prophylactic oral antibiotics. 42 (60%) of UA samples were culture positive compared to 21 (30%) positive LA samples. The UA positive group were not statistically different in age or FEV_1% pred (11.1 vs 10 yrs and 78% vs 75%). 14 patients were culture positive in both UA and LA, 10 of which had matched pathogens and 4 were unmatched. 20 were matched culture negative. The range of pathogens and where they were isolated are shown in the Table, some samples had more than one isolate.

Note the Table shows concordance for same pathogens
Conclusion In PCD, pathogens are isolated far more commonly from the UA than the LA. The clinical impact of these pathogens in the long term is unknown. 11 (16%) had PA in UA with only 2 of these having PA in their LA. We speculate that the UA may be, at least in some children, the source of LA infection. Clinical trials of eradication therapy after positive nasal cultures are indicated

Abstract P103 Table 1

Micro-organism	UA+, LA+	UA+, LA-	UA-, LA+
Strep pneumoniae	4	14	1
H Influenzae	*4*	*11*	*8*
Staph. Aureus	*2*	*0*	*2*
Ps. Aeruginosa	*2*	*9*	*1*
Moraxella	*2*	*4*	*0*
Other	*0*	*3*	*0*

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