controlled asthma with a mean predicted FEV₁ of 54%. 13/24 (61%) were on a maintenance dose of oral corticosteroids (mean dose 19 mg/day). The mean inhaled corticosteroids was 1006 µg. The cause of death was not known in 6 cases, with majority of cases died from non-asthma causes (78%) with cardiovascular disease being the most common. Asthma was the cause of death in 4/18 (22%) cases. Co-morbid diseases were prevalent particularly those that form the metabolic syndrome. Non-concordance with asthma medications and smoking history (current and ex-smokers) were also common (50% and 60% respectively).

Conclusion Although death is a rare event in our severe asthma service (0.7%), patients did die prematurely (mean age 51 yrs) usually from non-asthma causes, but asthma still accounted for death in the fifth of this group. Larger multicentre study with control data will be needed to confirm these finding and look for drivers and predictors of mortality in severe asthma.

New markers of lung physiology

P79 COMPARISON OF CF AND NON CF LCI RESULTS USING THE EXHALYZER D AND INNOCORTM DEVICES

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Background Multiple breath washout (MBW) is a pulmonary function test that allows measurement of lung clearance index (LCI), a marker of ventilation heterogeneity. LCI is increasingly being considered as a clinical trial outcome measure. The Exhalyzer D N₂ washout (N₂/ExD, Ecomedics AG, Switzerland) is the recommended technique by the ECFS CTN. Mostly our group's experience with LCI uses the InnocorTM gas analyser (Innovision, Denmark), SF₆ as a tracer gas (SF₆/Inn). To understand the N₂/ExD technique, the aims of this study were to compare a) intra-test variability; b) LCI values c) LCI and FEV₁ for the two techniques.

Methods 21 CF (14F, mean 20 ± 12 yrs) and 10 non-CF (8F, mean 28 ± 10 yrs) have completed MBW trials with the 2 techniques in random order on the same visit; methods previously described (Horsley *et al.* 2009, Jensen *et al.* 2013).

Results Intra-test CoV (2–3 repeats) was similar for SF₆/Inn and N₂/ExD (3.57 vs 3.78 CF, ns). LCI was significantly higher with N₂/ExD than with SF₆/Inn in both CF (14.05 vs 9.33; *p* = <0.0001) and non-CF (7.08 vs 6.64, *p* = 0.04). Both techniques show a significant correlation for LCI and FEV₁%, although the regression slopes were significantly different (*p* = 0.005); much steeper for N₂/ExD.

Conclusions LCI values cannot be used interchangeably between the InnocorTM and Exhalyzer D. In non CF, there was a statistically significant difference, with higher values in the N₂/ExD. The difference was much greater in CF and increased as LCI

did. In the context of similar intra-test variability, the hypothesis that this may translate into improved power in future clinical trials needs to be tested. Sponsored by a non-restricted grant from Novartis.

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P80 EXTRAPOLATING LUNG CLEARANCE INDEX (LCI) FROM SHORTENED MEASUREMENTS

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Introduction and objectives Shortened multiple breath washouts (MBW) are attractive in young children, where a long test time may not be tolerable (Thorax 2013;68:586–7). Lung clearance index (LCI) is usually calculated at 1/40th of the starting concentration (LCI_{std}), but in shorter MBWs the LCI is calculated at 1/20th of the starting concentration (LCI_{0.5}). LCI_{0.5} and LCI_{std} are closely correlated but not interchangeable, and so we calculated an extrapolated full LCI (LCI_{ex}) from LCI_{0.5}. Our hypothesis was that extrapolated LCI (LCI_{ex}) will better reflect LCI_{std} than LCI_{0.5} and be more sensitive to intervention.

Methods Condition-specific equations for cystic fibrosis (CF), primary ciliary dyskinesia (PCD) and asthma, and an overall equation for all 3 groups, were developed to convert LCI_{0.5} to LCI_{ex} from data previously analysed (*n* = 90, Thorax 2014;69 [Suppl²]A166). LCI_{std}, LCI_{0.5} and LCI_{ex} were then calculated for new cohorts (*n* = 70, 20 asthma, 30 CF, 20 PCD), and LCI_{ex} was compared to LCI_{std}. CF patients receiving IV antibiotics (*n* = 17) and asthma patients receiving triamcinolone (*n* = 32)) also had LCI_{std}, LCI_{0.5} and LCI_{ex} calculated and compared. The upper limit of normal for LCI_{std} was calculated from healthy controls. LCI_{ex} was compared to LCI_{std} with a Bland-Altman plot.

Results In CF, at higher LCIs, the spread between LCI_{ex} and LCI_{std} grew but there was no bias. For PCD and asthma agreement remained very good. There was no significant difference between LCI_{std} and LCI_{ex}. Results for positive and negative prediction of LCI_{std} for LCI_{0.5} and LCI_{ex} are shown in the Table 1. LCI_{ex} and LCI_{0.5} were also sensitive to interventions in asthmatic and CF patients, although in general LCI_{std} had better *p* values.

Conclusions LCI_{ex} performed better than LCI_{0.5} in predicting results of LCI_{std}. However, LCI_{ex} did not always reflect LCI_{std}, particularly in CF, so the two cannot be used interchangeably in lung disease.

Abstract P80 Table 1 LCI_{ex} had an improved false negative rate compared with LCI_{0.5}

LCI	Correctly categorised (%)				Sensitivity to intervention	
	True positive	True negative	False positive	False negative	Asthma	CF
LCI _{std}	-	-	-	-	<i>p</i> = 0.001	<i>p</i> = 0.03
LCI _{ex}	37	26	5	2	<i>p</i> = 0.02	<i>p</i> = 0.02
LCI _{0.5}	38	26	0	6	<i>p</i> = 0.02	<i>p</i> = 0.04

P81 **FEASIBILITY OF MEASURING LUNG CLEARANCE INDEX (LCI) IN A CLINIC SETTING IN PRESCHOOL CHILDREN WITH A RANGE OF AIRWAY DISEASES**

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Introduction and objectives LCI is a measurement of lung function (in particular distal airway disease) derived from the multiple breath washout (MBW) test (*Eur Resp J* 2013; 41:507–22). Although practical in a research setting, feasibility in a clinic setting (with limited time and without using sedation) in young children is not known. We looked at success rates of LCI, and LCI0.5 (a shortened washout which can be accomplished more quickly) in preschool children (aged 2–6 years) with recurrent wheeze (*Eur Resp J* 2008; 32:1096–110), cystic fibrosis (CF), recurrent cough/infections, and healthy controls. Our hypothesis (based on other research performed in this field (*Thorax* 2012; 68:586–587) was that shortened LCI0.5 would be more feasible than full LCI, and that the test would be more feasible in older preschool children than younger.

Methods 62 preschool children median age 3.9 (2.07–5.95) years, 34 male, (n = 21 with wheeze, n = 11 CF, n = 2 PCD, n = 22 other, n = 5 healthy controls) performed MBW test during a routine outpatient visit. Wheeze was doctor diagnosed or parent reported via wheeze questionnaire.

Results 66% of children successfully completed either the LCI or LCI0.5. Completion according to age group is shown in Figure 1. LCI success rate in wheezers was 67%, healthy controls 100%, CF 82%, PCD 100% and recurrent cough/infections 50%. Success rate was identical between males and females (61%), and was similar comparing LCI0.5 (42/62) to full LCI (38/62). Three of the four that only completed LCI0.5 were less than 3.5 years old.

Conclusions LCI is a feasible test in the clinic setting for preschool children; however success rates under 3 years of age in all disease groups are very low. Use of the shortened washout (LCI0.5) marginally improves success rates, but may improve test completion in the youngest children.

Abstract P81 Figure 1

P82 **LUNG CLEARANCE INDEX (LCI) AND GENOTYPE-PHENOTYPE CORRELATIONS IN PRIMARY CILIARY DYSKINESIA (PCD)**

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Introduction and objectives Mutation type may affect clinical phenotype in PCD, as shown by differences in forced expiratory volume in 1 s (FEV₁) (*AJRCCM* 2015;191:316–324). LCI, measured using multi-breath washout (MBW) is raised in PCD (*AJRCCM* 2013;188:545–549) but the relative sensitivities of the two physiological measurements is disputed (*Thorax* 2015;70:339–345, and 305–306). We hypothesised that LCI would be more sensitive to genotype-phenotype differences in PCD.

Methods MBW (using sulphur hexafluoride MBW with a photoacoustic gas analyser) and spirometry were performed in 77 PCD patients (mean age 16.4 years (range 4–62.2), 33 males, mean FEV₁ z score -2.09 (range -5.33–1.59)). 44 had outer dynein arms (ODA) defects, or both inner (IDA) and ODA, 18 had microtubular defects (either transposition or microtubule disorganisation with absent IDA), 15 had normal ultrastructure (diagnosis made on either genetics (n = 10), low nasal NO, clinical phenotype and consistent dyskinesia on light microscopy

Abstract P82 Figure 1 LCI is worst in other defects group than dynein arm defects ($p = 0.01$) or normal ultrastructure ($p = 0.0002$). FEV₁ is better in normal ultrastructure than dynein arm ($p = 0.04$) and other defects ($p = 0.007$)