£120 000 to £210 000 depending on the type of polysomnography requested. With nearly 50% patients managed with oximetry it would cost £68 400 to £113 000 leading to huge cost saving without compromising on the quality of service.

Conclusion Judicious use of oximetry can help deliver cost effective sleep service.

Improving delivery of care in cystic fibrosis

P234 THE IMPORTANCE OF APPROPRIATE REFERENCE EQUATIONS FOR SPIROMETRY: LESSONS LEARNED FROM THE CYSTIC FIBROSIS GENE THERAPY "RUN-IN" STUDY

doi:10.1136/thoraxjnl-2011-201054c.234

¹G Davies, ¹A J Simpson, ¹K J Bayfield, ²M J McGovern, ²M A Embley, ²H S Sheridan, ¹C Saunders, ²M H Dewar, ²S Cunningham, ³E W F W Alton, ²J A Innes, ¹J C Davies. ¹Imperial College, London, UK; ²University of Edinburgh, Edinburgh, UK; ³UK Cystic Fibrosis Gene Therapy Consortium, London, UK

Introduction and Objectives The "Run-In" study is an on-going longitudinal, observational study of CF patients assessing outcome measures for a future gene therapy trial. Spirometry is performed at each visit and volumes are converted to % predicted values according to published reference equations; historically these were separate for adults and children. Here, we describe the issues arising from this approach, and highlight the benefit of using a reference source which bridges the transition from child to adulthood.

Methods CF subjects (=10 years; FEV₁=40% predicted) were recruited from three sites in London and Edinburgh. Visits were undertaken during periods of stability every 3–6 months; data presented here are from the first four visits. Spirometry was performed on an Easyone spirometer. Volumes were converted to % predicted values according to Rosenthal (<18 years) and Quanjer (=18 years) reference equations. The FEV₁ raw data were subsequently re-analysed using Stanojevic reference equations, which span all age ranges. Comparisons were made using paired t-tests.

Results 191 patients attended visit 1 (mean age 22.7 years, 55% male; 91 patients <18 years). Rosenthal and Quanjer FEV₁% predicted values were significantly higher than the Stanojevic values: mean differences 2.8 (95% CI 1.9 to 3.7) for children with Rosenthal equations (p<0.0001), and 2.4 (95% CI 2.1 to 2.8) for adults using Quanjer equations (p<0.0001). 10 patients transitioned between paediatric and adult reference ranges during the study period; the slope of change in their FEV₁% over visits 1–4 was significantly greater with Rosenthal/Quanjer references than with Stanojevic (p=0.001) largely due to an artefactual drop when switching from Rosenthal to Quanjer values. As an example, a female patient aged 17.8 years at visit 1 had a drop in absolute FEV₁% predicted between visits 1 and 2 of 11% when Rosenthal/Quanjer were used but only 3% with Stanojevic reference values.

Conclusions Our results highlight issues raised when separate adult and paediatric spirometry reference ranges are used in longitudinal study. The UK CF Gene Therapy Consortium has adopted the Stanojevic reference source for all spirometry analysis in its ongoing Clinical Programme.

Funding UK CF Trust.

P235 A UK REGISTRY STUDY OF PROPHYLACTIC ANTIBIOTIC USE FOR STAPHYLOCOCCUS AUREUS IN CHILDREN WITH CYSTIC FIBROSIS

doi:10.1136/thoraxjnl-2011-201054c.235

D K H Lo, M H Hurley, A Prayle, A R Smyth. University of Nottingham, Nottingham, UK

Background The UK antibiotic guidelines for cystic fibrosis (CF) recommend that all infants should be prescribed a prophylactic

narrow spectrum antibiotic, such as flucloxacillin, from diagnosis until 3 years of age. We wished to evaluate the prevalence of prophylactic antibiotic use in the UK and the effect this had on the microbiological outcome of children with CF.

Methods A registry search was conducted on the UK CF registry to include all children <3 years at the time of the 2009 dataset (UK CF registry. Cystic Fibrosis Trust, 2011). Information on antibiotic prophylaxis ("chronic/oral antibiotic not prescribed to treat an exacerbation") and bacterial status (no growth, intermittent or chronic) are entered at the time of annual assessment and refer to the previous year.

Results We identified 609 children who were born between August 2006 and December 2009, for whom data were available. Of these, 480 children (78.8%) were on prophylaxis and, 385 (80.2%) were on flucloxacillin alone. Prevalence of chronic/intermittent *Staphylococcus aureus* and *Pseudomonas aeruginosa* were similar between those not on antibiotics to those on flucloxacillin only. The use of "other" antibiotics was significantly associated with an increased prevalence of *P aeruginosa* (p=0.005, Bonferroni corrected threshold=0.0125).

Conclusions Despite current recommendations a sizeable minority of children with CF are not on anti-*Staphylococcal* prophylaxis. Of those who are, the majority receive flucloxacillin. Given the limited dataset, we did not detect any significant differences in microbiological outcome between those on regular Flucloxacillin to those on no antibiotics. Of note, the prevalence of *S aureus* in the under three group is around 7% compared with the overall UK prevalence of 15.2%. Prophylactic use of antibiotics other than Flucloxacillin (mostly cephalosporins; n=36 out of 95) appear associated with increased prevalence of *P aeruginosa*. This is consistent with findings from a previous US study implicating cephalosporin prophylaxis in acquisition of infection with *P aeruginosa* (*J Pediatr* 2002;140:299–305). Randomised controlled trials with long term follow-up, using clinically relevant outcomes, are warranted in order to better understand the effect antistaphylococcal prophylaxis has on the progression of CF lung disease.

Abstract P235 Table 1

	Not on antibiotics	On regular flucloxacillin	On other (inc. combinations)	Total
Chronic/intermittent <i>S aureus</i> positive	10 (7.75%)	29 (7.53%)	5 (5.26%)	44
Chronic/intermittent <i>P aeruginosa</i> positive	20 (15.50%)	61 (15.84%)	31 (32.63%)	112
Chronic/intermittent <i>S aureus</i> and <i>P aeruginosa</i> positive	6 (4.65%)	23 (5.97%)	3 (3.16%)	32
No positive cultures	93 (72.09%)	272 (70.65%)	56 (58.95%)	421
Total	129	385	95	609

P236 CYSTIC FIBROSIS DEATHS IN USA AND UK: COMPARISONS OF REGISTRY AND ROUTINE DATA

doi:10.1136/thoraxjnl-2011-201054c.236

¹F Chowdhury, ¹M J Wildman, ²E Gunn, ³D Bilton. ¹Adult Cystic Fibrosis Centre, Northern General Hospital, Sheffield, UK; ²Cystic Fibrosis Trust, Bromley, Kent, UK; ³Royal Brompton Hospital, London, UK

Background MDT care in dedicated centres has been a contributor to improved Cystic Fibrosis (CF) survival and in UK and USA outcomes for patients in centres, and is collected by national CF registries. Routine national death data using ICD-10 codes will identify all CF deaths giving an indication of how many deaths occur in patients not receiving centre care. It might be suspected that the UK health service with universal access might have a

different mix of patients in the CF registry than the US insurance based health system despite the US CF foundation's attempts to reduce barriers to care. This study compared registry and routine deaths in UK and USA.

Methods UK and US routine deaths for ICD-10 E84 are provided in 5 year age bands and the age of death was taken as the midpoint age in the band. Medians were calculated with STATA.

Results US routine data are not yet published for 2007 onwards. The Abstract P236 table 1 shows total deaths and median age at death derived from routine and registry data for USA and UK.

Abstract P236 Table 1

Year	UK Total deaths routine	UK median age at death registry/routine	UK registry Total deaths (n) (%) missing	US total deaths routine	US median age at death registry/routine	US registry total deaths (n) (%) missing
2009	147	27/27	141 (6) (4%)	NA	26.1/NA	440 (NA) (NA)
2008	122	27/27	100 (22) (18%)	NA	26.3/NA	420 (NA) (NA)
2007	133	24/27	106 (27) (20%)	NA	25.9/NA	394 (NA) (NA)
2006	112	NA/27	NA	438	25.2/27	362 (76) (21%)
2005	108	NA/27	NA	414	NA/27	NA
2004	137	26/27	123 (14) (10%)	461	24.2/27	358 (103) (29%)
2003	117	24/24	136 (33) (24%)	447	25.4/27	370 (77) (21%)
2002	118	NA/24	NA	485	25.2/27	426 (59) (14%)

CF deaths in UK and US 2002 to 2009.

Discussion Both the US and UK have around 20% of CF deaths occurring outside centres though in 2009 in the UK this fell to 4%. In 3 out of the 5 years that allow comparison the median age at death was higher in UK registry data compared to the USA. Contrary to expectation the median age at death derived from routine data are higher than the age of death from registry data in all years where comparison is possible. Interestingly, in the US routine data the distribution were different to the UK with many more very old (over 70) patients. The increased age at death in routine data may in part reflect the imprecision related to the routine data only providing age at death in 5 year bands. The apparent higher proportion of very elderly in the US is intriguing and invites further study.

P237 DOES DESATURATION ON EXERCISE PREDICT NOCTURNAL HYPOXIA IN CHILDREN WITH CYSTIC FIBROSIS?

doi:10.1136/thoraxjnl-2011-201054c.237

¹J Keating, ¹N Collins, ¹M Rosenthal, ¹A McKee, ²D Urquhart. ¹Royal Brompton Hospital, London, UK; ²Royal Hospital for Sick Children, Edinburgh, UK

Introduction Exercise induced arterial hypoxia (EIAH) is well documented in cystic fibrosis (CF); though its relationship with nocturnal hypoxia remains unclear. In adult CF, hypoxia occurs more frequently during sleep than exercise,^{1,2} but this has not been investigated in children.

Aim To identify whether EIAH is a reliable predictor of nocturnal hypoxia in CF children.

Methods Retrospective case note review of 34 children with CF. All performed the modified shuttle test,³ overnight pulse oximetry and spirometry in the second week of an elective admission for intravenous antibiotics. EIAH was defined as drop in SpO₂ ≥4% from baseline.⁴ There is no agreed definition of nocturnal hypoxia, we assessed numerous overnight variables, mean and lowest SpO₂ and % time with SpO₂ <92% in sleep. Data were analysed using SPSS software (SPSS).

Results 34 subjects were assessed, median age 12 (range 7–16) years, and FEV₁ 72 (25–103) % predicted. Nine demonstrated EIAH and

five had nocturnal desaturation (SpO₂ <92% >10% sleep time). All children with SpO₂ <92% for >10% of sleep also had EIAH, this was significant (p=0.0086). The relationship between nocturnal hypoxia and lowest exercise SpO₂ (p=0.0076) was also significant. However, 6 of those with EIAH were not hypoxic overnight. The sensitivity of EIAH detecting sleep hypoxia was 75% and specificity 80%. Positive predictive value (PPV) was 33% and negative predictive value 96%.

Conclusion The PPV of EIAH for detecting nocturnal hypoxia is poor, but the definition of EIAH must be questioned. SpO₂ varying from 90% to 87% does not meet EIAH criteria, yet a fall from 97% to 93% does. We must also note that although the relationship between nocturnal hypoxia and EIAH appears significant the number of subjects in this group is extremely small. We conclude EIAH is not a reliable predictor of nocturnal desaturation and advocate a sleep study to confidently detect sleep hypoxia.

Abstract P237 Table 1

Sleep Exercise	SpO ₂ < 92% for <10% of sleep n=32	SpO ₂ <92% for >10% of sleep n=3	p Value	Drop in SpO ₂ <4% n=11	Drop in SpO ₂ ≥4% n=23	p Value
Baseline SpO ₂	97 (87–99)	94 (89–97)	0.1449	97 (94–99)	97 (87–99)	0.5397
% Change in SpO ₂	1 (–5–7)	10 (4–13)	0.0128	1 (–6–3)	2 (–11–18)	0.294
Number with EIAH	6 (16%)	3 (100%)	0.0086	1 (9%)	6 (26%)	0.3844
Lowest SpO ₂	95 (88–100)	84 (79–90)	0.0076	95 (93–99)	95 (79–100)	0.204

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P238 PRESCRIPTION ISSUE DATA AS A MEASURE OF ADHERENCE WITH NEBULISED THERAPY IN AN ADULT CYSTIC FIBROSIS CENTRE

doi:10.1136/thoraxjnl-2011-201054c.238

P I Wilson, S P Range, A C Murphy. *University Hospitals Leicester, Leicester, UK*

Introduction and Objectives Patients with cystic fibrosis are often prescribed complex time-consuming medication regimens. We know from studies in chronic diseases that most patients will be at best only partially adherent with their medication. We studied adherence with nebulised therapy in our adult CF clinic, by measuring the actual quantity of medication prescribed as recorded in General Practitioner and hospital computer prescribing records. The results were compared with the CF centre staff's predictions of adherence on an individual patient basis.

Methods We requested prescription issue data for 26 patients on nebulised dornase α, colistin and tobramycin both from the patient's general practitioners and from the hospital pharmacy. We compared the actual quantity of medication prescribed to each patient to the expected number of doses that they should have received during a 12-month period and calculated a percentage adherence based on these figures. Based on previous work in our difficult asthma clinic we assigned obtaining =80% of doses as being adherent; =50% but <80% as partially adherent and <50% as non-adherent with the medication.