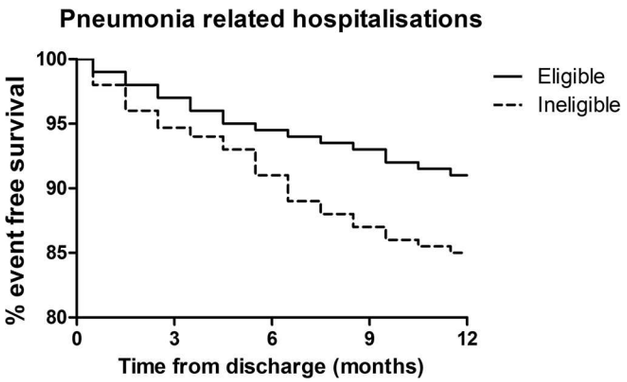
pneumonia hospitalisations in patients eligible and ineligible for TORCH.

There were 376 patients with COPD included from the Edinburgh pneumonia study. The 30-day mortality rate was 12.0%. 186 patients (38.0%) would have been ineligible for TORCH. After adjustment for relevant confounders, ICS use in patients classified as ineligible for TORCH was associated with increased risk of 30-day mortality (HR 1.85 95% CI 1.00–2.41).

**Conclusion** Patients ineligible for RCTs such as TORCH are at increased risk of ICS related pneumonia mortality and hospitalisation. Existing studies may therefore underestimate the true impact of ICS related pneumonia in the "real-world" setting.




**Abstract P224 Figure 1.**

## P225 INHALER USE AND MISUSE ON THE WARDS OF HOSPITAL

[1]D Long, [2]RB Reilly; [1]*Royal College of Surgeons in Ireland, Dublin, Ireland;* [2]*Trinity College Dublin, Dublin, Ireland*

10.1136/thoraxjnl-2013-204457.377

Clinicians are aware that inhalers are often improperly used incorrectly by patients. However, it often difficult to assess, because at present there is no tool that directly quantify adherence. We designed a device, the INCA device that makes an acoustic recording each time an inhaler is used. Opening the device starts the recording, this electronic sound file is "time-stamped" which means that the timing of drug administration is recorded, while analysis of the acoustics identifies the technique of inhaler use. When the INCA device is retrieved and acoustic analysis performed, the steps involved in using the inhaler are determined. Hence, both inhaler technique and the time when the inhaler was used can be identified. Together this means gives an objective quantitative assessment of inhaler adherence.

In this study we attached the INCA device to a diskus dry powder inhaler and studied inhaler use by people in Hospital who were prescribed a diskus inhaler.

Initial results from three general Hospitals (n = 50) indicated that there were errors in both overuse 15% of doses, missed doses in 30% of patients and poor inhaler technique was seen in 45% of patients, in no case was it suggested that the device be changed. Overall, <40% of inhaler doses were administered on time and in the correct manner. Investigation indicated that inhaler administration was not supervised which together meant that errors in inhaler use were not rectified. Subsequently we undertook an institution wide comprehensive practice change involving prescription review, changes to storage and administration policy, supervised inhaler administration to correct inhaler misuse and a follow-up when inhaler misuse persisted despite ward level instruction. Six months after the introduction of practice change a series of follow on audits were performed. One audit indicated that the storage and administration practice was adopted on the wards. The second indicated in 100 consecutive admissions that observed inhaler technique was adequate in 33% of patients on admission, improved in 33% and was unchanged by discharge in 33%. Thirdly, studies with the INCA device, (n = 40) indicated that overdosing was documented in only 2% of recordings, missed doses were reduced to 20% and 10% of patients were changed from one device to a more suitable one. Hence, data from the INCA device prompted a change in practice Improvements in inhaler use on the wards were achieved by a simple quality improvement intervention.

## P226 INHALATION CHARACTERISTICS WITH SPIROMAX® AND TURBUHALER® DRY POWDER INHALERS (DPI) IN HEALTHY ADULTS AND PATIENTS WITH ASTHMA OR CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD): BEFORE AND AFTER ENHANCED TRAINING

[1]H Chrystyn , [1]W Azouz, [2]P Chetcuti, [3]H Hosker, [4]D Saralaya; [1]*University of Huddersfield, Huddersfield, United Kingdom;* [2]*Leeds General Infirmary, Leeds, United Kingdom;* [3]*Airedale General Hospital, Bradford, United Kingdom;* [4]*Bradford Royal Infirmary, Bradford, United Kingdom*

10.1136/thoraxjnl-2013-204457.378

**Introduction and Objectives** Acceleration of inhaled flow from a DPI is important to facilitate de-aggregation of the metered dose and to ensure delivery of an appropriate dose. Patients need to inhale as fast as possible from the beginning of their inhalation manoeuvre and continue inhaling until their lungs are full.[1] This study investigated inhalation characteristics when patients and healthy adults (HA) inhale through placebo Spiromax® and placebo Turbuhaler® DPIs and assessed the impact of enhanced DPI technique training.

**Methods** This was a randomised, open-label, crossover study involving children (6–11 years old, [CA]), adolescents (12–17 years old [AA]) and adults with asthma [ADULT], COPD patients and HA. Study participants were trained to use the Spiromax and Turbuhaler DPIs according to the Patient Information Leaflets. Inhalation characteristics were measured.

Each participant received enhanced training using an In-Check Dial™ to measure inspiratory flow (IF). Participants were encouraged to increase their IF by inhaling more quickly. Inhalation characteristics were measured in the same way as before enhanced training.

**Results** Before enhanced training,peak inspiratory flow (PIF) and maximum change in pressure (P) were significantly higher with Spiromax versus Turbuhaler ($p < 0.05$; all patient groups). There were also trends towards slightly higher inspiratory acceleration (ACC) with Spiromax.

Table 1 shows the pre-training inhalation characteristics. Enhanced training significantly improved PIF, ACC and P ($p < 0.05$) in all subjects and in both inhalers except P with Spiromax in patients with COPD. Percentage improvements in P and ACC are shown in Table 1. Significantly greater improvements ($p < 0.05$) were seen with Spiromax versus Turbuhaler (post training) for PIF (all groups), P in AA, ADULT and patients with COPD, and for ACC in ADULT and COPD patients.

**Conclusions** Patients achieved faster IF and greater positive change in pressure with Spiromax versus Turbuhaler. Enhanced

**Abstract P226 Table 1.**

| | CA (n=23) | AA (n=27) | ADULT (n=50) | COPD (n=50) | HA (n=50) |
|---|---|---|---|---|---|
| **Spiromax: Before enhanced training** | | | | | |
| PIF, L/min | 69.5 (17.2) | 67.9 (15.10) | 74.4 (18.1) | 57.5 (21.0) | 85.0 (13.6) |
| ΔP, kPa | 5.0 (2.5) | 4.7 (2.2) | 5.7 (2.6) | 3.7 (2.7) | 7.3 (2.3) |
| ACC, kPa/s) | 13.6 (11.8) | 12.1 (8.8) | 15.6 (15.7) | 11.0 (12.8) | 15.9 (13.5) |
| **Turbuhaler: Before enhanced training** | | | | | |
| PIF, L/min | 58.5 (14.7) | 57.8 (13.4) | 65.4 (17.5) | 50.1 (16.2) | 78.0 (11.8) |
| ΔP, kPa | 3.9 (2.0) | 3.9 (1.8) | 5.1 (2.6) | 3.1 (2.0) | 7.0 (2.1) |
| ACC, kPa/s | 11.3 (8.5) | 11.4 (7.2) | 13.0 (12.1) | 8.4 (9.5) | 12.8 (9.6) |
| **Spiromax: % improvement after enhanced training** | | | | | |
| Improvement in ΔP, % (SD) | 53.46 (60.32) | | 49.30 (74.81) | 35.94 (81.15) | 46.36 (58.85) |
| Improvement in ACC, % (SD) | 165.71 (231.22) | | 247.72 (482.94) | 152.83 (233.91) | 212.09 (284.44) |
| **Turbuhaler: % improvement after enhanced training** | | | | | |
| Improvement in ΔP, % (SD) | 67.44 (68.36) | | 57.12 (89.53) | 60.30 (73.15) | 44.96 (55.92) |
| Improvement in ACC, % (SD) | 221.64 (335.34) | | 188.77 (271.47) | 254.32 (426.12) | 275.05 (389.83) |

All values are mean, standard deviation (SD) unless otherwise indicated.ACC = inspiratory acceleration; $FEV_1$, forced expiratory volume in 1 second; PIF, peak inspiratory flow; ΔP, maximum pressure change

training with a focus on maximising inspiratory effort produced significant improvement in inhalation parameters with both devices, and significantly greater improvements in these parameters with Spiromax versus Turbuhaler in adult patients.

## REFERENCES

1. Laube BL, *et al*. *Eur Respir J* 2011;37:1308–31.

## P227 EFFECT OF A NEW TRAINING DEVICE ON PMDI TECHNIQUE

[1]MJ Sanders, [1]R Bruin, [2]R Featherstone; *[1]Clement Clarke International Ltd., Harlow, UK; [2]Medical Device Usability Limited, Cambridge, UK*

10.1136/thoraxjnl-2013-204457.379

**Introduction** A simple training device (In-Check Flo-Tone®) has been developed to teach pMDI users when and how to actuate their inhaler via the sounding of an inspiratory flow whistle. Samples of the device plus instructions were made available to UK healthcare professionals who were invited, from April 2013, to take part in a short questionnaire survey. The objective was to assess the effect of the Flo-Tone device on pMDI technique.

**Method** Patient details (age, sex, asthma/COPD diagnosis and spacer use) were recorded. Four assessments were made by the healthcare professionals concerning the patients' ability to: Q1 - generate an appropriate flow rate; Q2 - press the can during the early part of the inspiration; Q3 - maintain adequate inspiratory flow after pressing the can; and Q4 - an overall assessment of pMDI technique. Ability was graded Poor, Average or Good on each occasion. Assessments were made before and after Flo-Tone training, and changes in technique were determined from the responses. A sign-test for improvement was carried out on those not already assessed as Good.

**Results** To date, 27 assessments of pMDI users have been received: 15 male and 12 female, age range 11–90 years (mean 51 years) with recorded diagnoses of asthma (n = 17) and COPD (n = 7). Four were spacer-users. The shift table (Table 1) shows the categorical changes before and after training. Following training, 19 users had improved their overall technique and 7 remained at the pre-training level (Q4); 20 had improved their ability to maintain an adequate flow and 6 remained at the pre-training level (Q3). Data for Q1 and Q2 were 15 and 12, and 8 and 18 users, respectively. The single loss of technique was an 83 year-old combined asthma/COPD patient. Analysis of those users not already rated as Good showed statistically significant improvements ($P < 0.05$) for Questions 1, 3 and 4.

**Conclusion** The data indicate that the Flo-Tone device may be a positive addition to the training tools available for pMDI users, and may be particularly useful for improving overall technique and the ability to generate and to maintain an adequate inspiratory flow.

**Abstract P227 Table 1.**

| | | | AFTER TRAINING | | |
|---|---|---|---|---|---|
| | | | Poor | Average | Good |
| Q1 | BEFORE | Poor | 2 | 3 | 6 |
| | | Average | 0 | 3 | 6 |
| | | Good | 0 | 0 | 7 |
| Q2 | BEFORE | Poor | 2 | 3 | 0 |
| | | Average | 1 | 3 | 5 |
| | | Good | 0 | 0 | 13 |
| Q3 | BEFORE | Poor | 2 | 3 | 4 |
| | | Average | 1 | 1 | 13 |
| | | Good | 0 | 0 | 3 |
| Q4 | BEFORE | Poor | 2 | 3 | 5 |
| | | Average | 1 | 2 | 11 |
| | | Good | 0 | 0 | 3 |

## P228 IMPACT OF LONG-ACTING BRONCHODILATOR THERAPY ON MORTALITY IN COPD: A REAL-LIFE RETROSPECTIVE COHORT STUDY

A Manoharan, PM Short, WJ Anderson, BJ Lipworth; *University of Dundee, Dundee, United Kingdom*

10.1136/thoraxjnl-2013-204457.380

**Introduction and Objectives** Long-acting muscarinic antagonists (LAMA) and long-acting beta-agonists (LABA) are first-line treatments for COPD. The addition of inhaled corticosteroids (ICS) is recommended for patients with frequent exacerbations who are not adequately controlled with long-acting bronchodilators. These medications have been largely evaluated independently in placebo controlled randomised trials. In this 'real-life' study we investigated the impact of these medications used independently and in combination on mortality.

**Methods** We conducted a retrospective cohort study using data from patients with a diagnosis of COPD in NHS Tayside between 2001 and 2010. All-cause and cardiovascular mortality was assessed using Cox proportional hazard regression after